THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE REWARD OF INDUSTRY.

AT the end of our leading article of November 3rd we indicated our intention of resuming the consideration of efficiency in industry, with particular reference to the bearing of reward upon the subject.

As our readers know, we have frequently expressed ourselves as being in favour, on general lines, of the dependence of the reward upon the services performed. There is more in this question than piecework, or the payment for the job in the shop, and there is more than profit-sharing, or the division of the surplus that remains out of revenue after expenses have been paid.

People engage in industry for the purpose of producing wealth, and wealth can only be produced by the application, direct or indirect, of labour to land. The land is the original capital, and the labour applied may produce crops, in which case no diminution of capital is entailed, or it may be devoted to the winning of coal to be burned, when diminution of capital occurs. It may also bring about changes in the form of the original capital, as when clay is made into bricks. In such cases as this, there is no increase or decrease in the amount of the capital, but there is an increase of availability, or immediate usefulness. It may be cynically observed that the chief motive for work of any description is personal profit, but since personal profit cannot (taking the broad view) be gained without the production and exchange of wealth of various kinds, we are justified, when taking, as we must, a brief survey of the present situation, in confining our attention to the wood rather than the trees.

All who co-operate in the production of wealth are entitled to reward for their services, and it seems clear that it would be reasonable if that reward had to depend, within limits and subject to certain conditions, upon the value of those services. The so-called capitalist, whose function is the supplying of a fund wherewith the work of preparing for and carrying on the process of production may be paid for, is entitled to payment for what he does, and to security against the loss of what he has provided. In other words, he is entitled to a reasonable return, or interest, on his money, and to insurance against the risk of some of his enterprises proving failures. It is clear that labour and management must be paid for their services, and it will be equally clear, we think, that the community is entitled to be supplied with whatever is produced at a price which is as low as possible consistent with the discharge of the obligations previously referred to. We assume, for the present, that the community consists of persons who are engaged in the pursuit of increasing the availability of wealth in one way or another, and if the producers of one kind of commodities demand excessive quantities of other commodities as their reward, other producers will follow in their footsteps, and the use of the articles produced will be restricted.

We have arrived, then, at the fact that all ought to be paid for their services, and that there is, or ought to be, a surplus available for division. Dealing first with the question of wages, or direct payment week by week or month by month for current work, there is room for variety in the methods by which the reward of labour shall be distributed. In some trades it is the custom to pay workers individually in accordance with what they produce. The cotton trade is an example of this. In others, regard is had to what is produced by the operatives as a whole, and a standard wage is fixed so that every worker receives the same amount, neither more nor

less. The engineering trade unions have always been averse to any form of payment by results, and some workers have called such a method of payment "a pestilential system." It must be assumed that a worker is not so inefficient or non-productive as to merit discharge from his employment; but the effect, upon an individual worker, of smartness and efficiency above the ordinary (unless, indeed, promotion to a better position can be obtained) is so remote that there is no inducement towards its attainment. For this reason there seems little doubt that payment by results leads directly to an increase of effort. We are not impressed by the suggestion that it would lead to scamped work, which could be prevented by a proper system of inspection, or to over-production and consequent dislocation, which would not occur if there were a Progress Department to lay the various processes out in advance.

Dealing next with the division of profits, it is clear that this must take place at less frequent intervals than those at which wages are paid—in fact, generally once a year. A more general interest, on the part of those employed in them, in the prosperity of industrial undertakings, seems to be required, and the subject has lately received a good deal of attention from many writers of experience.*

Mr. Seebohm Rowntree includes an interest, on the part of the worker, in the success of the industry in which he is engaged (or, to come nearer home, in the prosperity of his own employer) as one of the five essential *minima* by which industrial unrest is to be avoided, and a spirit of co-operation fostered between employers and employed. Summarised, these are: (1) sufficient earnings; (2) reasonable hours; (3) economic security throughout working life and in old age; (4) a reasonable share in the determination of working conditions; and (5) the interest previously referred to. He argues that the surplus profit ought to be shared between capital, labour, management, and the community. He does not appear to draw any distinction between those of the community who use the commodity which has produced the surplus—in other words, between the customers and the others; but the whole community, users and non-users, gets some advantage from the prosperity of a manufacturing or trading concern, through the medium of the corporation profits tax and the income tax. It may therefore be assumed that what Mr. Rowntree means is that some portion of the anticipated profit for the next trading year shall be devoted to a reduction in the price. In certain industries, such as that of gas supply, this is enjoined by law, and dividends are limited. He is in favour of giving a liberal share to management, and we are glad to find that he recognises the fairness of this course. The administrative staff, although, as Sir Lynden Macassey has said, it has not risen adequately to the greatness of its position, can do much to make or mar the success of a business, and it is time it was recognised that trained brain-workers ought to be able to get at least as much out of the practice of their profession as people get out of small businesses for which no special knowledge or aptitude is required. Yet many an engineer would be financially better off selling something that people *must* have, such as food or clothes, than in doing the work for which he is qualified by his expensive training.

We shall deal with Mr. Bowie's book in our "Review" columns, but it may be remarked here that its trend is towards co-partnership of a contributory kind, so that labour and management, like other shareholders, would receive their share of profits as dividend.

The prosperity of the nation depends upon the prosperity of the nation's industries. High demand and consumption must coincide with plentiful and cheap supply, and the two requirements are inextricably bound up together. Cheap commodities can only abound if we have the best manufacturing plant and work it efficiently, practise personal economy, have the best selling activities, and, above all, willing and contented workers. The result of the General Election has shown that the majority of the voters did not share the view that the capital levy would be efficacious in bringing about an improvement in the situation. This item of the Labour Party's programme was put forward with so little explanation, and the explanations that were offered were so conflicting, that no surprise can be felt at its non-acceptance. Manufacturers know only too well that capital is not being spent with any freedom at the present time, and any measure that savours of confiscation can only have the effect of increasing its shyness. It is natural to feel annoyed at the profiteer, and many would like to see him made to disgorge his ill-gotten gains; but the effect upon the financial situation of a move against monetary wealth in general could only be disastrous.

The Situation of the German Industry.

An unfavourable influence upon the German electrical industry has been exercised by the depreciation of the mark and the consequential suspension of industrial and private building activity. Orders for home account, according to a correspondent of a German newspaper, are only coming to hand in a scanty manner. This statement applies not only to large machines, but also to motors, meters, small electrical apparatus, heating and cooking appliances, lamps, switching apparatus, insulated conductors, telephones, &c. In general, customers complain of a scarcity of money and the lack of credit; in these circles it is not known where to get the means for making purchases, as the banks manifest great reserve. On the other hand, agriculturists, whose products command high prices, are still in the pleasant position of being able to equip themselves with electrical machinery and plant.

Concerning the export trade, it is stated that foreign orders are also diminishing, although this is assumed to be mainly due to the generally unfavourable situation of world economy. Besides the falling off in orders, the German electrical industry is unfavourably affected by the rise in the prices of raw and semi-finished materials of all kinds, particularly in the case of metals, the final result being naturally an increase in the costs of production.

Credit conditions between buyers and sellers have become so bad that the latter demand the payment of 50 per cent. of the value on the acceptance of a contract, but charge to the customers the prices prevailing on the day of delivery, as, for instance, in the case of brass sheets; and these conditions also exist in the electrical industry.

The Action of Light on Colours.

A question of some importance was raised in a paper read by Sir Sidney F. Harmer before the Royal Society of Arts recently, namely, the fading of colours of objects in museums due to the action of light. As director of the Natural History Department of the British Museum, the author has had opportunities of studying this effect, which is naturally of importance in the case of unique specimens of considerable value. It appears that a long series of investigations made by Dr. Russell and Sir Wm. Abney led to some important conclusions. It was found, for instance, that light (and not moderate heat) was the chief factor in producing fading, and that the rays at the violet end of the spectrum were most prejudicial. This

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* "Industrial Unrest: A Way Out." By B. Seebohm Rowntree. London, 1922: Longmans, Green & Co. Pp. 48. 1s. net.

"Practical Profit-sharing: A Survey of Existing Schemes at Home and Abroad." With an introduction by Seebohm Rowntree. Manchester, 1922; The Manchester Guardian, Ltd. Pp. 67 + v. 1s. net.

"Sharing Profits with Employees: A Critical Study of Methods in the Light of Present Conditions." By James A. Bowie, M.A. London, 1922; Sir Isaac Pitman & Sons, Ltd. (Pitman's Industrial Administration Series, edited by A. P. M. Fleming, C.B.E., M.Sc.Tech., M.I.E.E.). Pp. x + 222 + 11. 10s. 6d. net.

is fairly well recognised. But it also appears that the effect does not take place in vacuo, *i.e.*, if water-vapour and oxygen are excluded.

One line of investigation that naturally suggests itself is to use glasses for museum cases which check the injurious ultra-violet rays. Window glass transmits practically the whole of the spectrum, including ultra-violet rays, but there are varieties of Crookes and other glass which are much more effective in absorbing ultra-violet light. The trouble is that a glass which is sufficiently useful in this respect has a somewhat deep yellow-green coloration, and is therefore not very suitable for cases containing coloured objects; the colours would inevitably be distorted. Moreover, while such special glasses do check the fading, they do not eliminate it; the effect is slowed down, but is not banished. Some colours are more fugitive than others. Some moths and butterflies change appreciably in colour after only a few weeks' exposure to sunlight, but dark-coloured furs of animals may resist action for years. The general belief that oil paintings are more permanent than water colours is not always borne out by experience.

The most interesting point elicited, however, was the fact that electric light (from incandescent lamps) is much less prejudicial than diffused daylight, which is itself far less dangerous than direct sunlight. Hence it would seem that there is a good deal to be said for the use of electric light for the artificial illumination of rooms where objects that are liable to fade are on view.

Empire Resources and Empire Trade.

It is hardly possible to attach too great importance to the Economic Conference which the Government is calling for next year. Experienced men who know at first hand the resources of the Dominions will come Home to us sympathetically disposed toward the development of inter-Imperial Trade, anxious to secure the development and utilisation of their great natural wealth and resources as a means to that end, and emphasising once more their need of population for these great purposes.

It is a pity that when there is so large a population here waiting for work this Conference cannot take place at once, but the fact has to be recognised that the political situation in some of the British Colonies has occasioned delay in making arrangements so that it may not be possible for the gathering to take place until next summer. That prospect affords poor food for those who are pressingly hungry, and irritates those who are anxious to "get a move on," for unless something tangible can be prepared before the actual Conference takes place, whatever decisions are arrived at can hardly become effective for the winter of 1923-24, and it is now that the call for relief is loudest while employment schemes are being commenced and signs of trade improvement are about to develop into practical advance. We hope that though representatives cannot actually meet until next summer, everything that can be will be done in advance by cable, by postal communication, and by compilation of available information in convenient practical form so as to simplify the adoption of policies and expedite schemes. We have had reports of value on the water-power resources of the Empire, blue books on the general resources of the Empire and the need for cheap postal and electrical communication, and these are not documents which get so out of date as to be valueless. The views of some of the most experienced Colonial authorities on the interests of the Empire, as placed before previous conferences, are recorded therein. Later events of pressing and all-absorbing urgency—the late war, for instance—make men more or less excusably forget the existence of such books and their recommendations.

One of the matters on which it is contemplated the Government might take action in advance of the Conference is the encouragement of the circulation of British magazines and other British literature containing British advertisements by cheaper Colonial postage rates. For how many years has that cause been championed—also the appeal for means of electrical communication to be cheapened and multiplied? It is practically certain that these and other measures like them which could be arranged for without Empire delegates meeting face to face to re-discuss them, would do something to assist Imperial trade, and so make work. Let this "Peace and Tranquillity" Government take early steps to justify that title in ways such as these.

Mr. Amery, First Lord of the Admiralty, speaking at the British Empire Union last week, urged the adoption of means which would make it easier for the British investor to invest in an Empire security than to send his capital into other countries where it would certainly not be used for purposes which would assist British trade. The success of issues of fairly recent date suggests that the capital would be forthcoming.

But perhaps the point which appeals most to the imagination of those who desire to lessen unemployment at home, where at present, alas! we are sadly overcrowded, and who have visions of the grand and glorious future of the Empire when the population is there to develop those resources, is the encouragement of suitable emigration.

Nothing hastens degeneracy more than unemployment, and nothing breaks the heart and spirit of a British man or women more easily than the fear of a future without promise—a dead end without an outlook yielding occupation and contentment. Let us get on as quickly as may be with already sanctioned Empire settlement schemes. There are plenty of men and women who would be only too glad to go and help to develop the Colonies and add to the trade prosperity of their kith and kin who remained behind, if only they could obtain trustworthy information showing where they could find work such as they can do, and if reasonable assistance could be afforded them. Our own "Correspondence" columns and post-bag contain plenty of evidence that electrical men are willing enough to go and try their fortunes elsewhere. Is it impossible for anything which will satisfy their thirst for information to be expeditiously and authoritatively accomplished? In years gone by the Press used to have periodical reports, sometimes warnings, sometimes useful encouragements. Do any of the Dominions want anybody just now? If so, why are not publicity and propaganda being made use of to the full? Not pictures of the vastness of virgin soils, of farms and homesteads, with cows, a horse, and a child, but facts of a specialised trade or handicraft description.

British Broadcasting.

Elsewhere in this issue we give an account of the first three broadcasting stations to be set in operation in England. The commencement of the service inaugurates a new epoch in the development of radio-telephony in this country, which has done so much to promote the use of the Hertzian waves. Even five years ago the wonderful possibilities of radio-telephony could hardly have been foretold; now it has taken its place with aviation, almost as youthful an art, amongst the miracles of science that the twentieth century has brought forth, and will soon have become as matter-of-fact as the gramophone.

Obviously the system can be very effectively used for the purposes of propaganda, and in fact it was so used in the last elections in the United States, where it is not subject to control as in this country; State control has the advantage that the broadcasting of undesirable communications can be restricted, but on the other hand, the control exercised by the Government of the day might conceivably be exercised in favour of a political party. The whole question of what shall and what shall not be broadcasted will call for mature consideration.

Turning to the commercial aspect of the subject, the experience already gained in the United States is bound to be of value to those who are taking up the manufacture and distribution of receiving apparatus in this country, and we commend to their attention the able article which we reprint elsewhere, on "Radio Merchandising."

THE BRITISH RADIO BROADCASTING STATIONS.

In view of the general public interest in the development of radio telephony and the forthcoming establishment in this country of further broadcasting stations, in addition to the three existing ones, some particulars of the transmitting apparatus used will doubtless be acceptable. The British Broadcasting Co., Ltd.,* was incorporated on December 15th under the chairmanship of Lord Gainford to conduct the service, but the complexity of the problems that will have to be overcome will naturally necessitate the lapse of some time before the development of its full possibilities can be achieved.

Considering the extremely small amount of energy that is involved and the numerous transformations which it has to undergo, it will be conceded that from the electrical point of view the results already obtained are very satisfactory. The difficulties encountered are, however, more acoustical than electrical, and much improvement in this respect is hoped for; microphones, "loud-speaking" devices, and other components will be bettered, and it may even be found necessary to institute schools for the instruction of singers and speakers in the correct control of their voices, and in the use of the microphone, &c. Music may have to be re-written, and the acoustic properties of the transmitting studios are only a few of the many very complex problems that will require solution for the attainment of the most desirable conditions. Meanwhile broadcasting stations will suffer criticism on the score of the apparatus not functioning properly, whereas the real trouble will lie with the artists, for everybody is not suited to the work. Radio artists will have to evolve a new technique, something that is not yet fully understood.

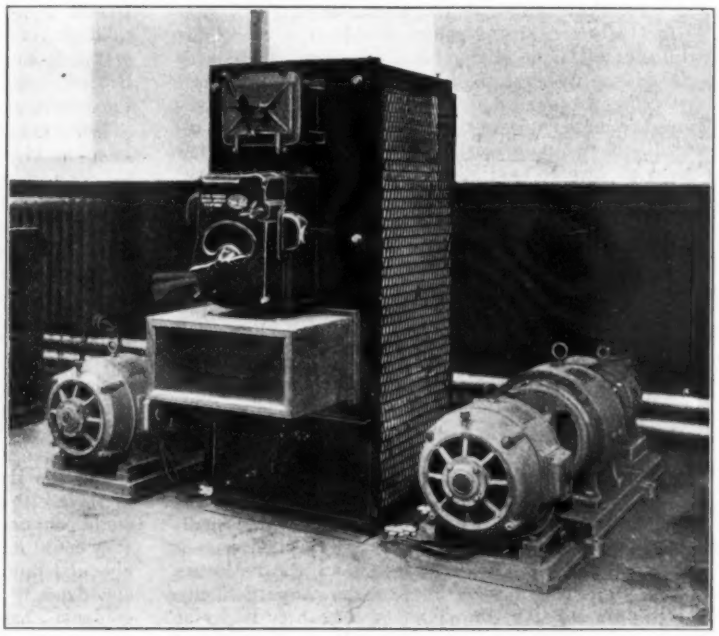

Fig. 1.—Power Generators at the Manchester Station.

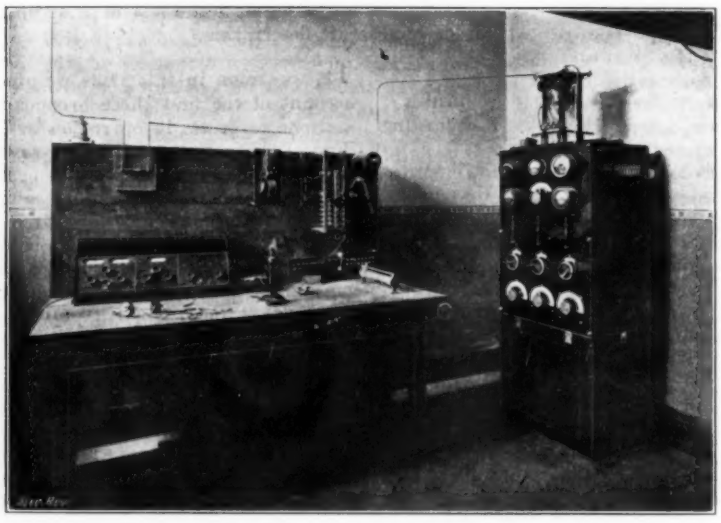

Fig. 2.—Transmitting Room at Manchester.

In the United States, over 500 stations are broadcasting, largely without reference to each other, the result being interference and confusion. Much time and thought have been given in this country to developing a scheme which, by pooling transmission patents, limiting the number of stations, and co-ordinating their operating conditions will preclude the possibility of such troubles arising in England. The popularity of radio-telephony in America may be judged from the fact that over two million receiving sets have been sold in two years. The British Broadcasting Co., Ltd., will ultimately operate at least eight stations respectively in London, Manchester, Birmingham, Newcastle, Cardiff, Plymouth, Glasgow, and Aberdeen.

The Manchester Station (call signal: 2 ZY; wave length: 385 metres; power: 1,500 watts) is situated in the Research Department at the works of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.

The power for the radio transmitting set is supplied by a small generator in the works power house at 440 volts, 50 cycles, 3-phase, and is employed to drive one of two triple sets, the second being a spare, consisting of an induction motor, h.p. generator, and exciter supplied by Messrs. Newton Bros., Derby (fig. 1). The h.p. generator is rated at 2.5 kW at 5,000 volts, and runs at 1,500 r.p.m. Suitable filter circuits are provided at the h.p. generator to remove the commutator ripple. The field of the generator is fed from the exciter through a potentiometer-type field regulator that enables stable adjustments to be obtained even down to very low voltages, which are occasionally required for test and experimental purposes.

Further details of these machines will be found on p. 851 of our issue of December 1st, 1922.

The transmitter panel (fig. 2) was installed by the Radio Communication Co., Ltd., London, and employs Mullard 0-500 valves. The h.p. d.c. supply at 5,000 volts is fed directly to the anodes of the valves, and suit-

* See "New Companies," this issue; p. 525, October 13th; and p. 609, October 27th, 1922.

able gear protects the generating set against short circuits. The power plant is remotely controlled from the transmitting room and, while a special listening station is provided some miles from Trafford Park, the character of the modulation is checked also in the transmission room. The filaments of the transmitting valves are heated from a 30-volt battery, and an artificial aerial is provided to enable tests to be carried out with a minimum of interference with other users of the ether.

The studio (fig. 3) is accommodated in a spacious room adjoining the transmitting room. The walls are draped with suitable hangings, and the floor has been carpeted, to avoid the resonance and echo from the floor and walls encountered in ordinary rooms. The equipment comprises a Steinway grand piano with a Welte player attachment, an Edison gramophone of the diamond-disk type, and an Aeolian Vocalion Graduola cabinet gramophone. The studio is connected to the transmitting room by multi-core cables, which may be used for microphone or other control circuits, the latter being run in a separate cable to avoid inductive interference.

The music and speech from the studio are picked up by microphones, or other suitable apparatus, supported on convenient stands. These sounds are given pre-

Fig. 3.—The Manchester Studio.

liminary amplification in the studio before being passed through the microphone cable to the transmitting room, where further amplification is carried out before the amplified currents are impressed on the aerial.

The aerial used is of the cage-type, and is suspended between the top of the well-known water-tower and the highest point of the main works buildings. The "lead-in" from the centre of the main aerial drops into one of the research laboratories. Each cage has six wires supported by suitable loops, the average height being about 160 ft. The station has worked, since its inception, on 800 watts, but the power is being increased almost immediately to 1,500 watts, the full power for which it is licensed.

A small experimental station, capable of transmitting 100 watts, has been erected at Hale. A single-phase induction motor on the Altrincham public electricity supply mains, driving a generator of 1,500 volts at 1,500 r.p.m., is used with an exciter. This station acts partly as an independent experimental station and partly as a control for the main broadcasting station, and is equipped with various receiving sets for "listening-in." The aerial is 150 ft. long, and comprises a triple wire with 12-ft. spreaders at a height of 75 ft.

The London Station (call signal: 2 LO; wave length: 369 metres; power: 1,500 watts) is situated at Marconi House in the Strand, the premises of Marconi's Wireless Telegraph Co., Ltd.

Power is taken from the public electricity supply mains at a pressure of 200 volts d.c., and the supply may be changed over from the ordinary network to the London theatre supply main; two separate and distinct sources of supply are thus available. The d.c. is taken through a switchboard to a 10-h.p. motor directly coupled to a 6-kilowatt single-phase, 300-cycle alternator, which supplies power at 500 volts a.c. The motor-alternator sets are in duplicate, and their two remote-control automatic starters are operated from a room at the top of the building, where the a.c. is supplied to the primary of a 6-kilowatt transformer (which, again, has a second transformer installed beside it with a change-over switch), the secondary winding giving a normal working potential of 22,500 volts.

The transmitter consists of four separate panels. The first is the rectifying panel, and its function is to convert the a.c. into d.c. at a pressure of approximately 10,000 volts by the use of two thermionic rectifying valves. The filaments of these valves are lighted from a highly-insulated transformer, the primary of which is connected to the 500-volt a.c. supply through variable and compensating inductances; the former regulates the filament voltage, whilst the latter compensates for line drop when the power load is thrown on to the line. This is accomplished by means of an automatic switch which short-circuits the compensating inductance the moment the load is switched on. The secondary winding of each power transformer has a central connection which is joined to the earth of the radio system. The two ends of the secondary winding are joined to the anodes of the rectifying valves, the filaments of which become the positive h.p., d.c., pole of the radio circuit. As soon as the alternating voltage is applied to the rectifier-lighting transformer, the filaments are lighted and the a.c. is applied to the rectifier anodes. The current passes through the rectifying valves in one direction only, alternating first through one and then through the other at the frequency of the alternator, *i.e.*, 300 times per second through each valve in such a manner that both sides of the alternating wave are rectified, resulting in a unidirectional current having a ripple on it of 600 per second. This current is then applied to the smoothing, or filtering, system, consisting of a condenser connected between the earth and the positive d.c. pole, which tends to smooth out the ripple that is on the top of the d.c. The current then flows through an iron-cored inductance, and so to a second smoothing condenser of a similar capacity to the former. Directly connected across the last condenser is a high resistance with a voltmeter in series with it, which measures the d.c. voltage and automatically discharges the condensers after the current has been interrupted. This prevents danger from shock which would occur if this leak were not connected. The h.p. d.c. passes through a milliammeter to the second panel that consists of an oscillatory circuit (the drive oscillator), composed of an inductance and condenser—one end of the inductance and one end of the condenser being connected to earth, whilst the high potential end of the condenser is connected to the anode of the oscillating valve, and the grid of the same valve is inductively coupled to the same inductance. The grid is also connected to earth through a high resistance across which is a small condenser. The anode of this valve is fed from the positive h.p. d.c. busbar through a milliammeter, whilst the valve filament is connected at one end to the negative earth busbar and at the other through a variable resistance to the positive l.p. busbar. The positive and negative l.p. busbars are continuous throughout the drive panel as well as the amplifier panel and the modulator panel. They are connected by means of a switchboard to a battery of 40 volts and 330-ampere hour capacity. The amplifier panel is in many respects identical with the drive panel. In it are mounted a closed oscillating circuit, consisting of an inductance and capacity, one end of the condenser and one end of the inductance being connected to the earth busbar as in the drive panel. Connected to the high potential end of the inductance is the anode of the second valve, which, in its turn, is again fed from the h.p. busbar, whilst its grid is connected back to the drive panel, and is there taken through an inductance coupled to the oscillating circuit of that panel. At

the same time this grid is connected to another inductance coupled to the closed oscillating circuit of the amplifier. Thus the transmitting valve grid potential is controlled from two sources, *i.e.*, the drive or the amplifier. The setting of these two reaction coils is of considerable importance, and should be so arranged that the grid is maintained in a state of varying potential by the oscillator, whilst the other reaction coil coupled to the amplifier is used merely to stabilise this action.

In the positive h.p. lead to this valve is inserted a large inductance (speech choke), by means of which the potential to the anode of the oscillating valve is varied. Each variation is carried through to the aerial, and this superimposes on the carrier wave from the aerial a complex ripple corresponding to the speech modulation. The aerial circuit (also connected in this panel) consists of an aerial terminal and variable inductance known as the aerial variometer and a coupling coil coupled inductively to the primary oscillating circuit. The end of this coil is connected throuh an aerial ammeter to the negative earth busbar.

The modulator panel consists of two valves—the control and sub-control valves. Both are lighted from the common l.p. busbars connected to the accumulator. The anode of the first valve is connected through the high resistance and through a protective choke to the speech choke, which is also connected to the positive h.p. busbar. The grid of this valve is connected through a resistance to the negative busbar and also through a condenser to the anode of the second valve. This valve also takes its h.p. current for the anode through a resistance and the protector choke from the positive h.p. busbar, whilst its grid is connected through a transformer to the negative busbar. The primary of this transformer is connected to the microphone in the concert room.

The aerial consists of two cage- or sausage-type aerials, each of which has four wires stretched between two masts nearly 50 ft. above the roof and approximately 100 ft. apart. The lead roof of the building, the steel framework, and the lightning conductors are bonded together to form a common earth for the system.

The microphone is arranged near the centre of the concert room and various instruments are grouped around it. Other facilities which are already in use, or are contemplated, consist of a private line direct to Reuter, so that the latest news may be received whilst transmission is actually in progress, and it is hoped that a line may be connected direct with the Greenwich observatory, so that time signals may be radiated.

The Birmingham Station (call signal: 2 WP; wave length: 425 metres; power: 1,500 watts) is located at the Witton Works of the General Electric Co., Ltd.

The equipment was installed by the Western Electric Co., Ltd., and the transmitter includes four 250-watt and one 50-watt valves; the total plate current and potential are 1.25 A and 1,600 V, and the total filament current and potential 28.4 A and 14 V respectively. The valves have oxide-coated filaments that operate at a dull red heat. The filament-heating current is supplied by a constant-potential generator, and is adjusted and held constant by means of the generator field rheostat.

The transmitter is essentially a generator of radio frequency energy (an oscillation generator), with means for modulating this energy in accordance with current variations produced by a microphone operating in conjunction with an amplifier and auxiliary equipment. The oscillator comprises vacuum tubes and a tuned circuit, including the antenna system, which determines the frequency and wave length of the radiated energy.

The frequency of the transmitted energy (wave length) is controlled by the value of the inductance in the oscillatory circuit which is adjusted by means of a variometer, a portion of the oscillator coil included in the antenna circuit being arranged to turn on an axis at right angles to its normal axis so that the inductance of the movable coil either aids or opposes the inductance of the remainder of the coil. The movable coil also serves to vary the coupling between the antenna circuit and that portion of the coil system which is connected to the plates and grids of the oscillator tubes in a manner to ensure satisfactory operating conditions throughout the frequency range for which the transmitter is designed.

A variable condenser across the plate coil controls the plate current through the oscillator tubes, and to a large extent the output of the tubes. It consists of a variable unit in parallel with two fixed units which may be switched in or out of the circuit as required.

In order to prevent distortion, the grid circuits of the modulating and speech-amplifying tubes are given a negative bias by means of a resistance connected between the negative terminal of the high-potential generator and the tube filaments.

The plate circuits are supplied with d.c. from a high-potential generator, and a noise filter is used to eliminate commutator noises. Under certain conditions, if the plate circuit is closed before the filament circuit, a destructive rush of current through the tubes may occur. To prevent damage due to this cause, a delayed-action relay is provided, which is operated by the filament current and requires approximately 20 seconds to function.

Power supply is obtained from a three-unit motor-generator set consisting of one high-voltage and one low-voltage d.c. generator, both connected direct to a 1,750-r.p.m. 5.5-h.p. driving motor on a common base plate.

Reception.—It was desired that, as far as possible, the B.B. Co. should be free from the risk of patent litigation, and it was therefore finally decided that the best plan would be for Marconi's Wireless Telegraph Co., Ltd., to grant licences under various letters patent for the specific purpose of the broadcasting scheme. The present service afforded by the three temporary stations described above should not be judged too severely, because until the B.B. Co. has come to agreement with the Press, with associations controlling copyrights, and kindred matters, high-grade programmes cannot be arranged for. Meanwhile, four British Press agencies (Reuter's, the Press Association, the Central News, and the Exchange Telegraph Co.) furnish each evening summaries of the world's news; the Meteorological Department of the Air Ministry supplies weather reports nightly, and in addition music and children's bed-time stories are broadcast.

It will be recognised that the educational possibilities of the service are appreciable, and in the future it will probably be preferable to broadcast a series of programmes, say, of dance music, grand opera, an educational lecture, perhaps a public speech, a news bulletin, and other suitable matter—all transmitted simultaneously, but at different wave lengths. It will then be possible for each "listener-in" to select the particular programme he is interested in by merely adjusting his receiver, and not be bothered with matter he does not wish to listen to.

Care is required in the selection of a receiving set; an ordinary licence holder's apparatus must comply with the requirements of the Post Office authorities (the Postmaster-General's approval, however, does not imply a guarantee of the efficiency or workmanship of any particular set), but an experimental licence allows some measure of freedom. The type required depends largely on the situation in which it is to be used with respect to the broadcasting station, and many of the sets which are on the market have been designed rather for experimental purposes than for practical telephonic reception. Some disappointment may therefore occur if purchases are made without full consideration of all the conditions.

Crystal sets are useful under ordinary circumstances within a comparatively small radius of the broadcasting station, although reception has been accomplished with them in exceptional cases over fairly long distances. If it is required to hear more than one station or to receive long-distance transmission, it will probably be necessary to use, in all cases, one of the larger sets employing a varying number of valves.

INTERNATIONAL ARBITRATION IN COMMERCIAL DISPUTES.

The Activity of the Court Established in Paris.

On various recent occasions we have referred to the establishment of a commercial court of arbitration in connection with the International Chamber of Commerce in Paris, and through the courtesy of M. Edouard Dolléans, general secretary of the Chamber, we are now able to give official information on the question as set forth in a pamphlet issued by this institution.

The creation of the court is the result of the labours in 1921 and 1922 of an influential committee composed of representatives of a number of countries, and its preliminary work was brought to a conclusion by the drawing up of a plan of conciliation and arbitration between traders of different countries. The principles embodied in this plan were approved by the London congress of the International Chamber in June, 1921, which congress authorised the Council to prepare a definite scheme for the organisation of the court. Regulations were subsequently drawn up by the committee, and these were approved by the Council of the Chamber in July, 1922, when it was decided to publish them and put them into operation.

As was mentioned in a previous issue, the scheme includes the formation of a National Committee for each country; each such committee groups together within the country concerned the different members of the International Chamber, and 16 such national committees were in operation last October. Each national committee appoints an Administrative Commissioner resident in Paris to work in collaboration with International Chamber's headquarters.

All correspondence with the parties to a commercial dispute will have to be carried on through the organisation members of the International Chamber if there is no national committee to undertake such communications. As organisation members, the Chamber accepts chambers of commerce and similar institutions, and bankers', manufacturers', or traders' associations, in countries where there is no national committee, pending the formation of such a committee; and a number of organisation members is enumerated in the pamphlet.

Coming to consider the composition of the court of arbitration, it is found that M. Etienne Clémentel, president of the International Chamber, also occupies the presidency of the court. Mr. W. Clare Lees, president of the Manchester Chamber of Commerce, and Señor Carlos Prast, president of the Madrid Chamber of Commerce, are two of the three vice-presidents, while the third had yet to be appointed on the publication of the rules two months ago.

The members for Great Britain are: Sir Albert J. Hobson, Sir Arthur Shirley Benn, Sir Algernon F. Firth, Dr. Walter Leaf, Sir Felix Schuster, the Hon. J. G. Jenkins, Mr. A. Barton Kent, Mr. Arthur Balfour, Mr. W. Clare Lees, Mr. H. L. Symonds, Sir Henry Whitehead, and Mr. O. E. Dodington. Among the American members of the court appears the name of Mr. Owen D. Young, chairman of the board of the New York General Electric Co.

The number of members of the Executive Committee corresponds to the number of countries affiliated with the International Chamber; and the member of the court appointed to sit upon the Executive Committee by each National Committee must be resident in Paris.

The Question of Conciliation.

The functions of the court, whose services are available to manufacturers and traders and financiers of all countries for facilitating, as far as possible, the settlement of commercial disputes, are divided into two parts, namely, conciliation and arbitration.

In the case of conciliation, any one of the parties to a dispute may request the good offices of the Administrative Commission of the International Chamber, and the party so desiring may request the intervention of the International Chamber in writing through his national committee, submitting at the same time a copy of the contract in question, together with copies of the complete documentary record of the transaction. On the receipt of the application, and the documents in support, the chairman of the Administrative Commission will enter into correspondence with the other party, through the national committee concerned, asking him, provided he accepts the services of the Chamber, to submit his statement of the case, supported by a complete documentary record.

The chairman of the Administrative Commission will associate with himself one or more members of the Commission depending upon the nature and importance of the case. After having rendered himself familiar with the documents submitted and having collected all possible information, the chairman, on behalf of the Commission, will communicate with the parties through their national committees, with a view to arriving at a basis of agreement acceptable to all the parties. In the event of failure to bring about a conciliation of the parties, the latter will be free to have recourse to arbitration or to submit the case to the proper courts; and nothing that has been done, said, or written in the attempt to reach a basis of conciliation shall affect their dispute in any manner whatsoever upon arbitration or before the courts.

The Arbitration Procedure.

The rules on arbitration are divided into two sections. The first applies to cases where at least one of the parties is a national of a country which does not provide legal sanction for the execution of arbitration awards, while the second deals with cases where all the parties are nationals of countries which provide legal sanction for the enforcement of awards. With the exception of two articles and one special article, the rules are exactly alike, and 18 articles are therefore common to both sections.

The court of arbitration or international committee on arbitration, as it is also termed, to which all questions connected with arbitration will be referred, will request the National Committees to furnish it with the names of technically-qualified arbitrators, as and when required, for appointment as arbitrators in cases submitted, and from among them the court will proceed to make the appointment. With the assent of both parties, the court may delegate any specific arbitration to any chamber of commerce or other organisation member of the chamber which maintains an organisation for arbitration. Whenever the parties have agreed to arbitration, the jurisdiction of the court is obligatory upon the contracting parties, and upon the refusal or failure of one of the parties to present his case before the arbitrators an award by default may be made.

It is provided that the arbitration shall take place in the country and town determined by the court, after examination of the request for arbitration and before the appointment of arbitrators; and all communications between the court, the arbitrators, and the parties concerned will be made through the medium of the national committees or the organisation members.

The court will appoint one arbitrator to try the case submitted to it, unless the parties desire either two arbitrators and one umpire, or three arbitrators. When two arbitrators and an umpire are appointed, the decision of the umpire will be binding; when there are three arbitrators the decision of the majority will be binding, or if no such majority is obtained, three new arbitrators are to be appointed to hear and determine the case afresh. Awards are to be given in a period not exceeding 60 days, although the court reserves the right to extend this period as circumstances may warrant.

If possible, the arbitrators are to utilise for clerical assistance the services of the staff of the organisation members of the chamber. The arbitrators may similarly take or obtain any legal or technical advice in reference to a dispute; the remuneration of such services and any expenses connected with them will be part of the costs. The court of arbitration may require all or one of the parties to pay or deposit such a sum of money as may be deemed necessary for the payment of any fees, costs, and expenses which may be incurred in the course of the proceedings.

It is further provided by the rules that all parties are in honour bound to carry out the award of the arbitrators. In the case of default, the court will have the right to request that the name of the defaulting party shall be published in the official publications of the International Chamber and in those of the National Committees, together with the text of the award so remaining unexecuted.

The Executive Committee of the court recommends all traders to insert the following clause in their contracts: —"The contracting parties agree to submit to arbitration, in accordance with the arbitration rules of the International Chamber of Commerce, the settlement of all disputes in connection with the interpretation or the execution of this contract."

In conclusion, it may be mentioned that the court is now in operation, and awards have already been made in the case of international disputes. The offices of the International Chamber are at 33, Rue Jean Goujon, Paris, where copies of the rules may presumably be obtained.

THE HICK, HARGREAVES CLOSED FEED SYSTEM.

A considerable amount of attention has been directed in recent years to the effective de-aeration of boiler-feed water to do away with much of the corrosion of boiler tubes which is caused by surplus oxygen in solution in the water.

Chemical methods have seldom proved really satisfactory, and this has led to the consideration of closed feed systems. These have also frequently proved difficult of adjustment and a source of anxiety to operating staffs. To do away with this, Messrs. Hick, Hargreaves & Co., Ltd., have designed a system which, it is claimed, is purely mechanical, automatic in operation, and readily understood by station staffs.

The essential features of the system are illustrated in the accompanying diagram (fig. 1).

Condensate is withdrawn from the main condenser A by an extraction pump B, and discharged into the steam-sealed feed

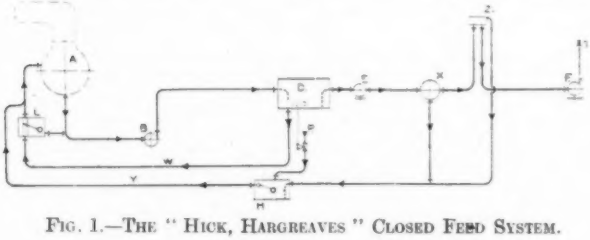

Fig. 1.—The "Hick, Hargreaves" Closed Feed System.

tank D, from which the lift pump E takes its supply of water and discharges it through a feed heater or house turbine condenser X to the suction of the feed pump F. As it is necessary to provide a head of water at the suction branch of the feed pump, a closed tank Z is provided in an elevated position for this purpose, any overflow from which is taken into the auxiliary tank H. The make-up supply is also taken into this tank under the control of a float operated by the rise and fall of the water in the main feed tank D. The water in the auxiliary tank H is passed into the main condenser A by a pipe Y under the control of a float valve, the valve being opened as the float rises, in this way disposing of any water which may collect in the auxilary tank, and ensuring the de-aeration of the make-up supply in the main condenser. To ensure the extraction pump B being fully charged with condensate and stabilised under all conditions of load on the main turbine, a pipe W is connected from the feed tank D to the main condenser A, the flow along this pipe being controlled by a float which rises and falls in the chamber L in accordance with the rise and fall of the water in the extraction pump suction pipe.

To conserve the heat in the drips from the feed heater or house turbine condenser X, a heater may be placed between the latter and the lift pump discharge. By this means the heat in the drips is given up to the boiler feed instead of being lost in the circulating water of the main set. This arrangement adds to the thermal efficiency of the system, and assists in the obtaining of a satisfactory heat balance.

The operation of the system is as follows: Assuming that the amount of condensate from the main condenser A is less than the requirements of the boiler house due to the main set being on light load, the amount of feed required will be provided from the main feed tank D, where there is an ample supply of water for the lift pump E to draw from. Under these conditions the float in chamber L will fall, allowing an increased supply of water to pass from the tank D along pipe W into the condenser, and thence to the suction of the extraction pump B, thus keeping the latter fully charged and stabilising its operation.

Should the demand in the boiler house continue to be in excess of the amount of condensate discharged from the main condenser, the level of the water in tank D will fall, lowering the float controlling the make-up supply valve and admitting an increased supply of make-up to the system. This passes along pipe Y into the main condenser, where it is de-aerated and afterwards withdrawn by the extraction pump B, thus making up the deficiency due to the extra amount of water withdrawn from the feed tank D. It may be that the demand in the boiler house is less than the amount of water delivered into the feed tank D by the extraction pump, in which case the excess water will flow down the overflow pipe from tank Z and thence back to the auxiliary tank H, from which it is drawn into the main condenser as before. This will have the further effect of raising the water level in the suction pipe to the extraction pump B, and closing the float valve operating in tank L, diminishing the by-pass water from the feed tank D to the surface condenser. It will thus be seen that any water fed to the boilers under varying loads on the main machine is de-aerated and kept from contact with the atmosphere, and by passing the condensate through the house turbine condenser the heat of evaporation in the steam condensed is added to the feed water on its way to the boiler feed pumps. An ample circulation of water through the condenser is assured, independently of the amount of condensate from the main set, so that the house turbine can operate under maximum load no matter what the demands in the boiler house may be, or what load is being carried by the main machine.

An Electric Boiler.—In a recent issue of *Power*, an electric boiler designed by the General Electric Co. (U.S.A.) was described. This consists of a cylindrical steel shell divided horizontally into two compartments. The upper compartment or electrode chamber is where the steam is actually generated, while below this is a hot well into which the water is fed and the surplus water from above returns. The water entering the hot well is forced into the upper compartment by means of a centrifugal pump. The boiler is arranged for three-phase working and the electrode chamber contains three large cylindrical iron electrodes rigidly fixed to the roof of the shell, the supporting rods being brought through specially-designed insulating bushes. These insulators are provided with a small duct leading to the open air, so that if steam succeeds in leaking through the packing into the upper section of the bushing it passes out freely instead of setting up a pressure which might blow out the side of the insulator. Normally, the electrodes are submerged in the water, and the three-phase current passes from electrode to electrode and also through the water to the sides of the tank and the neutral of the system. The mechanical circulation of the water by the centrifugal pump keeps the temperature of the water in the system uniform. If the steam pressure is lowered owing to an increased demand, rapid steam generation, due to the high temperature of the water and the degree to which the electrodes are submerged, quickly brings the pressure up again.

These electric steam generators have been designed for pressures ranging from 200 lb. maximum to 15 lb. minimum. Tentative layouts have also been made on generators of 3,000-kW capacity operating at one pound pressure. These generators can be designed for any boiler pressure now being used, up to 50,000-kW capacity and down to 250 kW. Below the latter limit generators of this type would probably not be so economical to build as some sort of immersion type using a metallic resister.

Russian Peat for Generating Electricity.—Interesting experiments have been carried out with peat fuel at the Schatursk electric station, where, with the Makaryeff stoking system, under the supervision of P. M. Botcharoff, engineer, and in the presence of a special committee of experts, &c., using two boilers of 340 m² heating surface each, with an average load of 4,000 kW on the turbines, the product was 9.7 kWh per pood (36 lb.) of peat. The consumption per kWh was 1.7 kg. of fuel. The experiments are to continue, but enough is known to base great hopes on the new system, called the "Chain" system, for the use of peat fuel, says an important Russian journal.

POWER PLANT TESTING.

In connection with the recent engineering exhibition at Cardiff, which was held under the auspices of the South Wales Institute of Engineers, a conference was held at the same time at the Institute, at which several papers were read and discussed, amongst them being the one abstracted below, which was closely followed by a large number of engineers from South Wales, and also from England, who visited the exhibition. Mr. David E. Roberts (president S.W.I.E.) presided, and the lecture was illustrated with lantern slides.

The author, Mr. W. M. Selvey, Wh.Sch., M.I.E.E., dealt briefly with his subject under two headings.

Section 1: *The Principles Involved.*—Between the performance of the plant under "test conditions" and under "running conditions" there is a very important difference. Two classes of apparatus may be made to the same specification, and yet be of such a nature that one lends itself to misuse by indifferent operation. while the other may be so designed that any misuse leads to such obvious failure to do the required duty that such incorrect operation becomes at once noticeable, and the scope of the personal equation of the operator is thereby greatly limited. Wear, in many cases, and sometimes small damage, which do not prevent the running of machines and may for a time escape notice, cause considerable loss in efficiency. All these matters should properly be discovered at an early date by "routine testing." This branch of testing does not always receive the attention which it economically merits.

In the past very little attention has been paid to sectionalising the plant, so that data necessary for expert operation can readily be obtained.

There is no particular difficulty or expense in providing such sectionalisation in a new plant, and it is done by designers to-day when the purchasing engineer has clearly in his mind that he is buying plant to run, not only effectively, but efficiently. Thus, three main considerations arise:—

(*a*) The need of definition in the specification to enable the carrying out of adequate "acceptance tests."

(*b*) The need of facilities for examining the capability of the plant to meet best the conditions of every-day working leading to "operation tests."

(*c*) The need of facilities for continuously watching the performance and condition of the plant as it fouls, wears, or depreciates, leading to "routine tests."

Specification.—Much difficulty has arisen in practice through want of definition in specifications for power plant. Many engineers have put requirements in a specification, which, bluntly, have represented what they would like. Often they are of such a nature that it would be impossible to prove whether the plant fulfils such requirements, or alternatively, the proving would require such a large expenditure that they would be the first to recoil from calling for such proof. Such clauses are worse than useless, and it is perfectly easy for any manufacturer to ignore them, fully realising that they will never have to be faced.

The second, and more frequent matter, is to call for a requirement which can only be met under some ideal conditions, seldom, if ever, occurring. Many attempts are made to meet such circumstances by adding to the specification complicated correction curves, dealing with the effect on the performance of the plant of variation from the conditions assumed as "standard." Such procedure may meet with a measure of success if the purchasing engineer is advised by someone who has been connected with the use of such correction curves. It is common experience to find, however, when settling up particular points before the "acceptance tests" are run, that some main matter has been overlooked or omitted (generally in quite good faith) and the legal effect of varying the "contract terms," even by agreement, may often be surprising to the engineer. Referring to the inadvisability of responsible managers spending too much time on details belonging more properly to the province of the expert, since 1914 much good work has been done in this direction by the British Electrical & Allied Manufacturers' Association (B.E.A.M.A.), which has led to much standardisation and uniformity of reasonable requirements, and this is reflected in many of the specifications of the Association (B.E.S.A.).

It is advisable, therefore, when drawing up a specification (which calls not only for steel and cast iron, but for plant to do certain work, at a certain cost for doing it) to specify very clearly what are the essential guarantees, and to express them in a form which an independent engineer can "take hold of," for the purpose of proving compliance or non-compliance.

Bonus or Penalty Clause.—Large sums have, in practice, been added to or deducted from the contract price under such clauses. It is, however, very unfair and risky to implement such a clause without a test by an independent expert, especially so if (as in some cases) the tolerance of inefficiency furnishes only a narrow margin between acceptance and total rejection. During the war such clauses were practically in abeyance, but when normal times are reached and free competition returns much is likely to be heard of them.

Section 2: *Apparatus for Testing.*—This is a very considerable matter. From the scientific point of view all measurements have ultimately to be referred to standards of weight (*i.e.*, mass) length, and time. More often than not what is actually measured is a "rate," and instruments for measuring rates are now becoming very elaborate.

The operations in certain tests (fuel, oil, &c.) are generally and preferably conducted by an independent chemist, but the onus of sampling is on the engineer conducting the test. This is a matter for great consideration.

Routine Testing.—Smaller stations and industrial plant have very little provision for such work, and in this direction much improvement may yet be hoped for.

Conclusion.—The author has attempted, in hurriedly reviewing a very large subject, to point out:—

(*a*) The necessity for clear definition in the "specification" of all matters which it is intended to put to the proof at the time of the "acceptance test."

(*b*) The need for, and value of, many special tests during the life of a plant, directed towards ascertaining the best method of operation, which tests have been termed "operation tests."

(*c*) The growing need for, and value of, instruments which define the conditions under which a plant is run and record as far as possible the results obtained therefrom, so that without special preparation attention can be particularly directed to any doubtful points leading to what has been termed "routine tests."

In the discussion which followed Mr. C. T. Allan (Cardiff) expressed the view that for practical testing it would be worth while for the apparatus to be all in one testing room. In some of the big stations all the long-distance recorders could be brought to one place, and probably a film taken, and then the staff could take the records from them. As to the acceptance test in power stations, no doubt most of them knew that that was a "blind between the purchase and the supply," and nothing else. He emphasised the value of a certain degree of efficiency.

Mr. Regan (Powell Duffryn Co.), contended, with regard to practical testing, that the more preferable way would be to see that the plant was always running under test conditions, and he did not think spasmodic testing, except experimental, was of much use. As to recorders, he considered they should be of a robust type.

Mr. Crosswaithe expressed the opinion that makers of instruments had done their best to put up a race for scientific control. He mentioned that a glass CO_2 recorder which he fixed on a Japanese ship went all the way out to the East and back, and a record was kept every day, the whole thing proving quite satisfactory. With regard to the use of scientific instruments, it was recognised by his firm, and he believed by some other firms, that the engineers of large iron and steelworks and such like undertakings were the "hardest nuts to crack" with their scientific talk. They found they could get on easier with toffee makers, &c.

Mr. E. J. Lea remarked that it had always been plain to him that the supplier and the municipal engineer were in two different camps, and he considered it would be of greater advantage to both if there was a little more co-operation. In all the works he had been in there always was a fued between construction and maintenance men, which was, to his mind, a great misfortune.

As a manufacturer of electrical instruments, Mr. Knowles viewed the future with optimism, and expressed the opinion that as regarded measurement the position would soon be such that they would be able to get instantaneous. He maintained that no mechanical method for collecting a large number of results in no way gave such facilities as electrical methods did.

Mr. W. M. Selvey briefly replied to the discussion.

Awards to Inventors.—The Second Report of the Royal Commission on Awards to Inventors (Cmd. 1782; 6d. net) contains particulars of 145 cases in which awards have been sanctioned or refused for articles patented and used for the public service. Claims on the part of inventors in the service of the Crown have been approved where it has been considered that their inventions have been made outside the scope of their duties. Among the awards made in respect of electrical inventions the following are included: Mr. H. Leitner (£3,500), and Messrs. Joseph Lucas, Ltd. (£200), dynamos for aeroplanes; Messrs. G. H. Nash, R. A. Mack, B. B. Grace, and G. E. R. Penney (£6,000)—Nash "Fish" hydrophone and Western Electric hydrophone equipment; and Professor J. S. E. Townsend (£1,000), portable electric wavemeters for use in radio-telegraphy. Claims for radio-telegraphic and telephonic inventions, made by Messrs. Marconi's Wireless Telegraph Co., Ltd., and the Lodge Muirhead Syndicate, Ltd., were adjourned generally.

E

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Rotary Switch with Overload Release.

Messrs. Van Wijk & Visser, of Geldermalsen, Holland, have designed a small-capacity switch, with a snap action, fitted with a simple overload release device. It is particularly suitable for private lighting installations, being arranged to deal with a normal current of 6A at 250 V, the release action operating at 50 per cent. overload—9 A. The movement may, however, be adjusted to operate at any current between 6 and 10 A. A larger size for normal currents of 10 A is also made. The switch mechanism is free of the

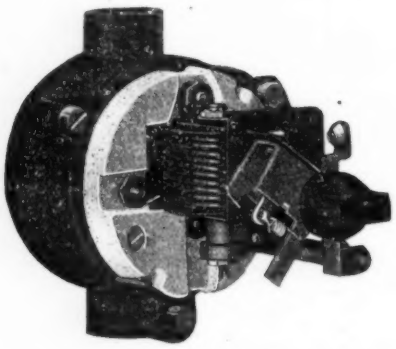

Fig. 1.—Small Switch with Overload Release.

handle, and is thus opened on an overload although the handle be held. The release is effected by means of an electro-magnet coil, which attracts a small steel core. This moves a rocking arm, at the upper end of which is a pawl engaging with a spring ratchet arm. The latter bears one of the switch contacts and the movement of the rocking arm allows the ratchet arm to spring forward and break contact. Through an opening in the front of the case can be seen a small indicator,

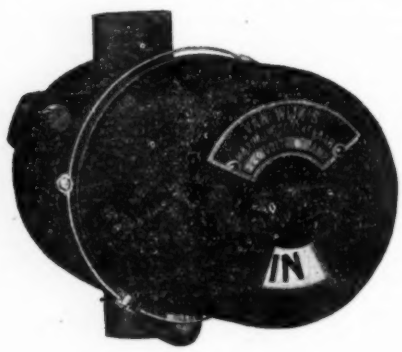

Fig. 2.—View of Exterior.

which shows the switch's position. The mechanism is protected by a slight but substantial case, and is mounted on an unglazed base; being provided with terminal pins, it can be removed from the socket and replaced by another with ease. Apart from its use to do away with fuses, which cause trouble in replacement, the appliance would serve well as a current limiter in installations where energy is charged for on a maximum-current basis. Fig. 1 shows the switch with the cover removed and mounted on a conduit box. Fig. 2 is an exterior view. The agents for the switch are the N.V. Electriciteits Maatschappij Electrostoom, Rotterdam.

New Automobile Ammeter.

An automobile ammeter, very simple and rugged in construction, has recently been developed by the Westinghouse Electric & Manufacturing Co. Although designed primarily for automobile use, its compactness and reliability make this instrument, which is known as the type "BT" ammeter, particularly well adapted for use also on motor boats, aerial craft, farm lighting plants, radio sets, and for charging batteries. The design of the "BT" ammeter involves a radical departure from the principles used in all previous ammeters, in that no wire connections or coils are used. The case of the instrument has a magnetic yoke or loop projecting to the rear, through which is passed the current-carrying cable or wire, which functions as a coil. The yoke has pole pieces extending into the inside of the ammeter. These poles vary in magnetic polarity and strength, corresponding to the direction and strength of the current passing through the wire and, being made of a special alloy steel, act without any residual magnetism error which would change the zero of the instrument. There is also a fixed permanent magnet inside the instrument with poles located at right angles to the poles formed by the yoke. Pivoted on a shaft in the centre of this group of poles is a soft iron vane which takes up a position

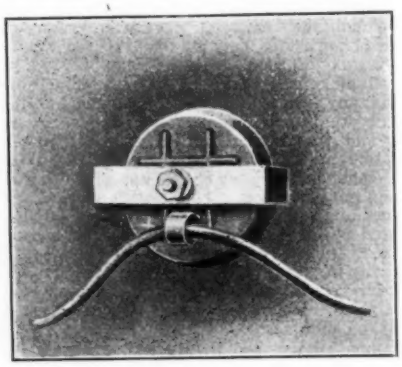

Fig. 3.—Westinghouse Type "BT" Ammeter.

corresponding to the relative strength of the permanent and the electromagnetic poles. The shaft carries the usual pointer which indicates the value of the current on a dial. The movement is so balanced that car shocks or swaying will not cause the pointer to swing.

This peculiar construction makes installation extremely simple, for, instead of wiring the meter to the car system by means of two pieces of wire or cable with connections and clips, the only operation necessary is to pass the dashboard cable through the opening in the back of the instrument, as shown in fig. 3.

A New "Magnet" Cooker.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has recently developed a new type of portable electric cooker (fig. 4) designed for cooking meals for from 6 to 8 persons. The appliance is substantially constructed of sheet metal, it is double-cased, and finished in black enamel with

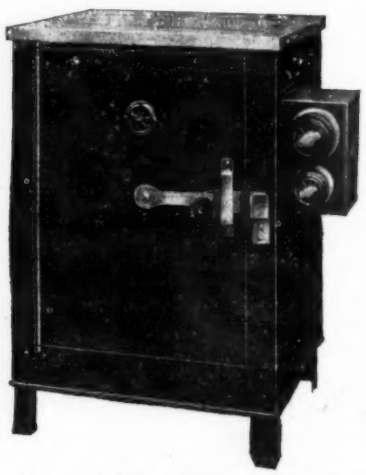

Fig. 4.—A New "Magnet" Cooker.

bright metal relief. It is 25½ in. in height, 18 in. wide, and 15½ in. deep; the oven space measures 17⅛ in. by 10½ in. by 12½ in. There are three heating elements, totalling 2,700 W, two at the sides of the oven and one at the top. The last is used not only as an auxiliary heater for the oven, but also for grilling, toasting, and boiling. By means of the heat controls, the effective loading can be brought down from the maximum of 2,700 to 300 W in 15 steps.

LEGAL.

Cooper *v.* Marks.

In the Mayor's and City of London Court, on December 19th, before Sir Ernest Wild, K.C., Recorder, Mr. Charles A. Cooper, manufacturer of electrical appliances and metal worker, 35, Kensington Hall Chambers, claimed against Mr. Hyman Marks, 19, Ludgate Hill, E.C., surveyor, £20 14s. damages, for breach of covenants in a lease to keep 48, Stamford Street in repair. Defendant paid £6 into Court with a denial of liability. Mr. Green, for the plaintiff, said that he had a lease of the premises for nine years at £75 a year in 1919. Plaintiff undertook not to carry on any business except that of a manufacturer of electrical appliances and metal worker. Defendant agreed to keep the main timbers in good repair and condition. Soon after plaintiff started his business he found the joists were not as they should be and he called defendant's attention to it. Nothing was done and as plaintiff was afraid that the ground floor would fall in and possibly kill some of the workers, he had the premises put into what his architect advised was a safe condition. Defendant said that the plaintiff must do the work at his own expense, and that if he put too many machines into the premises he must take the consequences. Mr. Picciotto, for the defendant, said that he had not broken his covenants. The joists complained of were not main timbers. The premises were never out of repair. Plaintiff had used the premises unreasonably. £6 was quite enough to satisfy plaintiff's claim. The Recorder said it was easy to cut down another man's bill. Defendant covenanted to keep the main timbers in good repair and that was not done. He found that the joists were main timbers and he gave judgment for the plaintiff for £16 18s., and costs.

Theft of Electricity.

Albert Frederick Hughes, an employé of the Liverpool Tramways Department, was fined £5 on December 20th, for the fraudulent consumption of electricity. It was stated by the prosecution that the defendant inserted two needles in an electric cable and used the energy for lighting his hut. The Stipendiary in fining Hughes, said that he refrained from sending him to prison only because he would no doubt lose his employment.

Mica & Asbestos Insulating Co., Ltd., *v.* Fellows Magneto Co., Ltd.

In the King's Bench Division, on December 18th, 19th, 20th and 21st, Mr. Justice Coleridge was engaged in hearing an action by plaintiffs, of Leroy Street, Old Kent Road, in which they claimed from the defendants, of Cumberland Avenue, Park Royal, two sums amounting to £2,460 for goods sold and delivered. In the alternative the plaintiffs claimed damages for alleged breach of contract by defendants in refusing to accept the goods, consisting of mica disks and plates used in the construction of magnetos.

The plaintiffs' case was that under three contracts they supplied to the defendants 2,600,000 mica plates, which they said were cut to the specification of the defendants. The plates were of no marketable value for any purpose other than that for which the defendants required them, except as waste scrap material.

The defendants admitted the order given to the plaintiffs, and said that the contracts contained a clause giving them the right of rejection in case the plates were found to be inferior in quality or in any way defective. They alleged that the plates delivered were, to a large extent, inferior in quality and defective and unfit for the purpose for which the defendants required them. Defendants further said that they were badly cut and otherwise did not comply with the specification. Defendants also pleaded that they had returned the goods, and that under the circumstances they had the right to reject them.

Plaintiffs, in reply, denied that defendants had the right to reject the goods, and denied defendants' allegations as to the plates being of inferior quality or defective in any way.

A great deal of evidence having been taken on both sides,

Mr. Schiller, K.C., in summing up the case for the defence, contended that there were defects in the mica which made the plates absolutely useless, because those defects destroyed the non-conducting quality of the substance, a fact which he said had been fully borne out by the witnesses. If there happened to be any conducting substance on the surface or the edges of the plates, then non-conducting properties would be destroyed, and the electricity would escape, and in this case a total defect in the plates was that they were of such varying thickness that they could not be put into the magnetos. The limitation of tolerance in many cases had been far exceeded, and when a portion were found to be so defective the defendants were entitled to reject the whole, as it was impossible from a business point of view to examine all.

His Lordship, in giving judgment, said he accepted the view that the contract was both by sample and description, but it was an unfortunate fact that defendants had destroyed the samples, and he was consequently unable to make a comparison. He adopted the view that it was a sale by sample plus description, and the basis of the contract was that the goods must be fit for the purpose for which they were required —that the mica must be free from bubbles and of good quality, and that the plates should not vary in thickness. It was admitted that some of the goods were not according to contract, but the rejected goods seemed to a large extent to have been the goods of other people. He had come to the conclusion that some of the goods were not according to sample, but there never had been any reluctance on the part of the plaintiffs to rectify any deficiency. In the end his Lordship gave judgment for the plaintiffs for £2,203 11s. 1d. with costs, and dismissed the counterclaim with costs.

A stay of execution was granted on the usual terms.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Conditions in Australasia.

I am a single man, 25 years old, and I should like to know if any readers of the Electrical Review can give me any information as to what conditions are like in Australia or New Zealand for power maintenance and armature winding and all electric motor repairs, as I have had a good deal of unemployment, and I would like to try somewhere else. I am not a graduated scholar, therefore I should not expect too much pay for a day's work.

E. Ranger.

Sale, *December 18th*, 1922.

Improvement of Power Factor.

With reference to the discussion which is at present taking place in your "Correspondence" columns on the above subject, Mr. Rogers is apparently under a misapprehension regarding the application of condensers on circuits of 200 or 400 volts. If a condenser is designed for, say, 600 volts working pressure, there is nothing to prevent the use of an auto-transformer to transform up the supply pressure from either 200 or 400 volts to the 600 volts. This arrangement is not covered by any master patents, and to give some idea of the respective costs, taking a case where a condenser applied to 600 volts costs £200, this condenser could be applied to a 400-volt circuit and give the same leading kVA for the additional cost of about £60, which is the cost of a suitable auto-transformer. If the circuit in question should be 200 volts, the approximate additional cost of the auto-transformer would be about £90.

It is agreed that 600-volt cases without the use of an auto-transformer are cheaper than either the 200- or the 400-volt case, but even with the increased cost, the condensers used in conjunction with auto-transformers are being applied very extensively, and effect savings as high as 100 per cent. per annum, and even greater than this.

Out of a total of nearly 30,000 kVA of static condensers, with which I am closely associated, a great percentage of this has been applied in conjunction with auto-transformers, and has effected savings sufficient to pay the cost of the equipment in from one to two years' time.

Other means of raising the voltage across condensers can be employed and have their applications, but there is certainly no question of master patents in reference to the application of an auto-transformer to raise the voltage across the condenser. This arrangement is very flexible in that the equipment can be applied to any part of the circuit where power-factor correction is required.

H. Higham.

Helsby, *December 18th*, 1922.

With further reference to correspondence relative to the above subject in your issue of December 15th, I would inform Mr. Rogers that I have recently compared the question of costs of static condensers for installations at 400 to 3,000 volts, at 50 and 25 cycles, and in every instance a profitable return on capital outlay has been shown.

In my own particular case, the condensers are connected direct at 600 volts; whilst I cannot give any information regarding condensers on 200-volt circuits, as such low voltage supply for power has not come within my sphere as yet, I look forward to seeing Mr. Dorey's figures relative to this voltage, as he evidently has had actual practical experience with it.

C. Jones.

Chasetown, *December 16th*, 1922.

I have been very interested in the recent correspondence in your columns under the heading "Improvement of Power Factor," and have derived useful information therefrom.

I should like to refer particularly to a letter on page 896, by Mr. W. E. Rogers, in which he makes use of a cryptic remark concerning the elimination of master patents.

Although I have been associated with the manufacture and application of static condensers for power factor improvement for some years, I am quite unable to determine which patent he refers to, and I feel that there must be others to whom this particular remark is equally unintelligible.

May I, therefore, trespass on your space to ask Mr. Rogers if he would be kind enough to state more fully the actual patent which he considers to be a master one, in connection with the application of static condensers to power-factor improvement.

L. F. Fogarty.

Ruislip, *December 20th*, 1922.

The Duty of Engineers in Parliament.

A leading daily paper recently complained that not a single person distinguished in scientific research had been elected to the new Parliament, and remarked that even the Universities had sent politicians. But on examining the list of members it is encouraging to find quite a goodly company of men directly interested in engineering construction. There appear to be no fewer than nineteen engineers, nineteen directors of engineering or iron and steel-producing companies, two architects, four contractors, and eight trade unionists representing workmen in constructional and engineering trades; altogether some 52 members. These 52 men make up a formidable phalanx, and their influence is certainly very strong in proportion to their numbers.

Although belonging to different parties, they have a common interest in helping the engineering and constructive trades, which are suffering badly, into activity once more. The writer suggests that they should come together and form a special Parliamentary Committee for Engineering Construction, pledging themselves to help forward, irrespective of party considerations, all useful public works and private enterprises which offer any hope of restoring prosperity to their trade. In so doing they would help to cure their country of one of its sorest wounds. All through the war these trades worked day and night for victory; and in spite of the wretched treatment of managers, foremen, designers, and others, whose salaries were forbidden to be raised, these men worked up to the limit of human endurance, Saturdays and Sundays alike, for four years. Their reward is in many cases to find themselves out of a berth.

The first business of Parliament to-day is to set the constructional and engineering trades going again. Without bias in favour of any party, the greatest hope of this new Parliament is that it will prove to be practical and constructive, and that the Government will devote itself chiefly to good administration rather than legislation.

The great electrical and other schemes do not require Government money, nor Government management. All that is required is a Government guarantee of interest on the capital for a reasonable term of years. This would cost the Government nothing, and would enable the money to be raised.

Special mention might be made of the super-power stations, which, if completed, should give us an electrical development worthy of the country, as that, of course, is the subject of most interest to electrical readers, but there is plenty of other work urgently required, which only wants Government sanction, and in some cases the backing of Government credit (not necessarily cash) to be put in hand. The canals would provide work for a large proportion of the unemployed, if they were freed from the domination of the railways and properly equipped and extended.

Village and country water supplies are urgently required, as well as electric lighting, heating, and power. If the villages and small towns were properly equipped, one great cause of the migration to the big towns would be removed. Drainage and refuse disposal, housing, and transport all require the attention of the nation. One of the greatest obstacles to agriculture to-day is the lack of transport and distribution at reasonable rates. It is a scandal that good produce should be ploughed in within a few miles from London, while the price here is prohibitive to the majority of Londoners. Roads and railways are being developed to some extent at last, but it is a scandal that beautiful and healthy residential districts round London should remain practically inaccessible to the daily worker, owing to the inadequate travelling facilities.

It seems that in the application of practical science we are twenty years behind the times. And this is not the fault of our engineers nor our contractors. It is the fault of our Parliament and politicians. They have neglected to equip this country as a modern civilised state which ought to be fit to rank with Germany, the United States, Switzerland, Norway, Sweden, and Denmark in the use of applied science.

Let the fifty-two see to it and help materially toward settling the question of unemployment and many of the financial problems which weigh us down. What is required is to use the country's credit wisely and promptly to promote its prosperity, before the remains of our credit follow our cash into limbo. It requires courage and common sense, and the immediate strangulation of anyone who stands up in his place to repeat the inevitable formula that we must "Cut our coat according to our cloth," a silly saw which every duffer uses to obstruct sound enterprise. What John Bull requires is a good suit of clothes befitting his position in the world, and it should be cut to fit his own stout figure, and, without waste, sufficient cloth should be provided for the purpose.

Critic.

Advertising Gas by Electricity.

I am interested to see the ingenious way in which the gas industry has got over the difficulty of fire risk and fumes. In the showroom of a celebrated furnishing house in the Tottenham Court Road area, in the centre of one of the windows displaying drawing-room furniture is to be seen a gas fire. I noticed that there was no flue, also that the gas outlet at the back of the fire was close up to a highly-polished table. Further investigation disclosed a flexible wire running to the back of the gas fire, and then the truth was revealed. The gas fire radiators were lit up by "Linolite" lamps, but to the casual observer the gas fire had the appearance of being alight.

Thus does electricity come to the aid of gas.

W. B. Clarke.

Ponders End, *December 18th*, 1922.

Possibilities of Underground Transmission at 100/150 kV.

With reference to the discussion which took place at the Institution of Electrical Engineers on the 7th inst., it is apparent, from comments which have been made to me from certain directions, that I did not succeed in putting my case as clearly as I should have done either in the paper or in the discussion. This is unfortunate, for I claim that in the paper proposals are made which represent true and considerable progress, and as the comments which have been made may prejudice the reception of my paper at other centres, I would ask you to be good enough to insert the following brief *résumé* of what I claim can be deduced from the paper.

In my reply to the Institution discussion I shall show that:

1. By using intersheaths in the manner advocated in Table III (on page 17) it is possible to apply something approaching 70 per cent. greater voltage to a given total depth of insulation than in any non-intersheath cable.

2. The use of this extra voltage enables me, for the same current density and for half the amount of copper, to reduce the thermal gradient on the innermost core to 72 per cent. of that in a non-intersheath cable, with greatly improved life of the cable.

3. The thermal gradient for a single-core non-intersheath 100,000-volt cable of a given diameter, as compared with a 3-core, non-concentric, 55,000-volt cable of the same diameter, is of the order of 40 per cent. of that for the latter.

4. The thermal gradient in an intersheath cable on my principle is further improved by some 20 per cent. by the fact that the copper heat is liberated nearer to the circumference of the cable.

5. Combining items 2, 3, and 4, we get a total reduction of temperature on the innermost core (and on the insulation) of nearly 75 per cent.

(Alternatively, I might raise the voltage by perhaps another 20 per cent. or 30 per cent., because a cooler insulation can bear a higher voltage gradient, with again further diminution of the copper temperature and consequent further relief of the insulation.)

6. The extreme importance of temperature is emphasised by the lantern slide which I exhibited, showing connection between resistivity and temperature, and by the calculations (on page 17 of the paper) dealing with conductance leakage.

7. On the score of complication, I do not think it has been appreciated that I can entirely drop the so-called "major-star" system, and my system then simply becomes, at the sending end, three double-star transmission systems, and would compare practically as favourably, as regards switchgear arrangements, as three ordinary three-phase step-up transformers.

8. It is only necessary to add that the outermost intersheath, which in my system forms so important a feature from the point of view of the reliability and efficiency of the cable, *could not be operated* by the "straight tap" method of feeding intersheaths.

A. M. Taylor.

Birmingham, *December 22nd*, 1922.

The Longest Overhead Power Transmission.

I shall be obliged if your readers will inform me of any overhead power transmission line in this country giving a regular supply of electric energy 50 miles or more distant from the generating station producing the supply. If a "ring" system is used, the distance in miles from both directions should be given, stating whether or not the "ring" is regularly used.

William T. Taylor.

London, N.10, *December 23rd*, 1922.

[Several letters have been received too late for insertion in this issue.—Eds. Elec. Rev.]

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XCI of the Electrical Review, which will shortly be printed, will be supplied only to those who specially apply for it through the post. To these it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—H. N. Miles (Sheffield and Midland Schools of Wireless Telegraphy), wireless instructor, Central Chambers, High Street, Sheffield.—First meeting December 27th, at the Official Receiver's offices, Sheffield. Public examination January 11th, at the Court House, Sheffield.

H. J. W. Embury and K. S. Embury (H. & K. Embury), electrical and mechanical engineers, 110 and 29, Queen Street, Newton Abbot.—Receiving order made December 18th on debtors' own petition.

W. Price & Co., electricians, 29, Russell Street, Plymouth.—Receiving order made December 18th on creditor's petition.

A. C. Ince (formerly carrying on business as the Newcastle Electrical Engineering Co., now with a partner under the style of the Tyne Electrical Industries), electrical contractor, 21, Fenkle Street, Newcastle-on-Tyne.—Last day for proofs for dividend, January 11th. Trustee: Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

Company Liquidations.—The British and Allied Electrical Agency, Ltd., 13, Charterhouse Street, London, E.C.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of creditors was held recently at the offices of Messrs. Clarkson & Bennett, I.A., 16, Devonshire Square, London, E.C. Mr. St. John Bennett, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which showed liabilities of £4,245, all of which were due to unsecured creditors. The assets were estimated to realise £95, from which had to be deducted £60 for preferential claims, leaving net assets of £35, or a deficiency as regarded the creditors subject to the costs of liquidation, of £4,211. The assets consisted of cash in hand £1 5s. 6d.; book debts estimated to realise £51; stock £22; and furniture and fittings £118, expected to produce £20. The liquidator stated that the liabilities included a claim by the Inland Revenue in respect of E.P.D. amounting to £870. If that claim was in order, and it had to be regarded as preferential, there would be no assets available for the creditors. The liabilities also included the following cash claims: Messrs. H. H. & A. T. Pollock, £168; Messrs. A. W. Pollock & Sons, £1,208; Messrs. A. & W. Pollock & Sons, Ltd., £885; Mrs. Pollock, £17; and Mr. Santell, £147. A private conference of the company's creditors was held on September 12th last. The creditors were then asked to postpone their claims for a period of 12 months with a view to giving the company an opportunity of pulling itself round. One creditor refused to fall in with the proposal, and commenced proceedings. The company had then no alternative but to pass a resolution for voluntary liquidation.

In answer to a question the liquidator stated that there was a book debt for £2,000 due to the company with regard to a deal in connection with insulated tape, but it was very doubtful if anything could be recovered without proceedings being commenced.

The creditors decided to confirm the voluntary liquidation of the company, with Mr. Bennett as liquidator.

Electrads, Ltd.—Winding up voluntarily. Liquidator: Mr. G. F. R. Baguley, 133, Moorgate, E.C. Meeting of creditors, December 29th, at this address.

Electro-Metallurgical Extraction, Ltd.—Winding up voluntarily. Liquidator: Mr. J. A. Charlton, Bank of England Chambers, Tib Lane, Manchester. Meeting of creditors, January 4th, at the offices of the liquidator.

Schoop Syndicate, Ltd.—Winding up voluntarily. Liquidator: Mr. R. H. Porter, Austin Friars House, Austin Friars, E.C. Meeting of creditors, January 5th. Particulars of claims to the liquidator by January 31st.

P. S. Doherty (Engineers), Ltd.—Winding up voluntarily. Liquidator: Mr. E. Woodroffe, 9 & 10, Pancras Lane, E.C., to whom particulars of claims should be sent by January 5th. Meeting of creditors, January 5th.

Midland Electric Rotary Blowing Co., Ltd.—Meeting of members is called for January 23rd at 46, Cherry Street, Birmingham, to hear an account of the winding-up from the liquidator, Mr. J. Wood Massey.

George Airey & Co. (Electricians), Ltd.—Winding up voluntarily. Liquidator: Mr. J. Hancock, 57, Surrey Street, Sheffield. Meeting of creditors, January 4th, at the liquidator's offices.

Dissolutions of Partnership.—Young & Goodall, radio engineers, 186, Above Bar, Southampton.—Mr. J. Young and H. R. Goodall have dissolved partnership. Mr. Young will attend to debts and continue the business alone.

Kissack & Yates, electrical and mechanical engineers, 179, Gt. Howard Street, Liverpool.—Messrs. A. M. Kissack, A. Yates, and A. H. G. Mowatt have dissolved partnership. Debts will be attended to by Messrs. Kissack & Yates, who will continue the business under the same style.

Barrington & Ferry and/or The Strandlite Lamp & Electrical Co., 37 and 38, Strand, W.C.—Messrs. W. M. Barrington and C. Ferry have dissolved partnership.

Private Arrangement.—Claude H. Verity, trading as Edwin Verity, 168 and 169, Briggate, Leeds, electrical dealer, &c.—A largely attended meeting of the creditors of the above was held on December 18th at the Victory Hotel, Leeds, when Mr. C. Turner, of Birmingham, was elected to the chair. Mr. Robinson, solicitor, of Albion Street, Leeds, who had issued the notice convening the meeting, explained the necessity which had arisen for the calling together of the creditors, and a statement of affairs was presented which had been prepared by Messrs. Fuller, Higgins & Co., 39, Albion Street, Leeds, showing the position as at December 7th last. The statement disclosed ranking liabilities of £40,041. Of that amount £14,614 was due to the trade, £12,852 to cash creditors, and £12,574 to partly secured creditors. The claims of the partly secured creditors totalled £14,074, but they held securities of the estimated value of £1,500. The assets were estimated to realise £14,849, from which had to be deducted £557 for preferential claims, leaving net assets of £14,291, or a deficiency of £25,749. The assets consisted of cash in hand, £231; stock in trade at cost £8,395, estimated to realise £6,716; trade fixtures, fittings, utensils, &c., £1,118, expected to produce £300; motor wagons, £627, valued at £200; synchroniser and Veritiphone £7,251, estimated to realise £1,000; patent stove, £704; shares, £65; insurances paid in advance, £21 16s. 6d.; good book debts £3,656, expected to produce £3,291; doubtful and bad debts £126, valued at £60; and surplus from securities in the hands of creditors fully secured, £2,260. The claims of the fully secured creditors were £7,970, but they held securities of the estimated value of £10,230. With regard to the preferential claims, they included rates, taxes, and wages of £503. For the purposes of the statement the good book debts had been depreciated by 10 per cent., and the other assets had been written down to what it was thought they would produce. The statement was explained in detail by Mr. G. Higgins, who reported that the debtor had carried on business for a number of years. Up to two or three years ago the business was a profitable one, but more recently it had ceased to be so owing to the general trade depression, and the abnormal slump which had taken place in that particular trade. The debtor had also expended a considerable amount of time and money on his personal invention—the synchroniser and Veritiphone. That was an instrument for producing the sound of the human voice for use in conjunction with films, the sound coinciding with the lip movements on the film and so producing a speaking film. The debtor had anticipated a company being formed to put his invention on the market, but unfortunately the necessary capital was not forthcoming. The debtor thought that the trade depression was responsible for the company not being formed. The position disclosed was discussed at some length, and eventually it was decided that a deed of assignment should be executed, with Mr. G. Higgins and another as trustees, for the general benefit of the creditors, together with a committee of five of the principal creditors.

Trade Announcements.—Messrs. H. Jones and C. E. Overton announce that, having severed their connection with Messrs. Hudson, Sheed & Towell, Ltd., they have fitted up premises at 6, Windmill Street, Tottenham Court Road, London, W., under the title of Metalcraft, Ltd., for the manufacture and sale of electric light fittings and accessories. A stock of fittings will be carried and a plant is installed for the renovation, replating, and relacquering of every type of metal-work.

Messrs. P. L. Dwyer & Co., wholesale electrical suppliers, of 66, Victoria Street, S.W., have removed to 30, Grosvenor Place, S.W.1; stores entrance, Chester Mews, Wilton Street, S.W.1.

Messrs. O'Sullivan & Sons have started as motor, electrical, &c., engineers at Lynch's Quay, Queenstown, Ireland, and they wish to receive catalogues and lists.

Messrs. Parmiter, Hope & Sugden, Ltd., have removed their head offices and works to Fluvent Electrical Works, Vernon Street, Longsight, Manchester, to which address all communications and goods should be sent. New telephone number: "Rusholme 1486."

Catalogues and Lists.—Messrs. Crompton & Co., Ltd., Chelmsford,—Export List 536, illustrating and describing silent-running a.c. fans. Fully priced.

The Underfeed Stoker Co., Ltd., Coventry House, South Place, E.C.2.—An illustrated brochure, describing the "F" multiple retort stoker.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—Two illustrated folders, dealing respectively with shop-window lighting with X-ray reflectors, and glassware for decorative electric lighting.

Calendars, Diaries, &c.—The Radio Press, Ltd., of Devereux Court, Strand, London, W.C.2, have published a wireless handbook and diary for 1923 containing a quantity of wireless data, with numerous diagrams, much general information, and an insurance coupon.

From The Key Engineering Co., Ltd., of 4, Queen Victoria Street, London, E.C.4, we have received one of their celluloid calendars for 1923.

A wall calendar with monthly slips for 1923 has been received from the Liverpool Electric Cable Co., Ltd., of Linacre Lane, Bootle, Liverpool. The pictorial feature is a view in colour of the entrance to Canning Dock, Liverpool.

"After the Rain" is the title of a coloured picture of country scenery which appears on a wall calendar (monthly date slips) issued by Messrs. Fred. Hodgson & Co., Ltd., of 24, Queen Victoria Street, London, E.C.4.

We are indebted to The Diamond Blower Co., Ltd., of 91-93, Bishopsgate Street, London, E.C.2, for useful seasonable souvenirs in the shape of pocket matchboxes.

The Hart Accumulator Co., Ltd., of Stratford, London, E.15, has prepared a large wall calendar; the figures on its monthly date sheets are very boldly printed. The firm has also sent us, as before, one of its desk blotting pads with the 1923 dates arranged on the right and left hand of each sheet.

Messrs. C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne, have sent us a set of date refill cards suitable for the calendar issued by them a year ago.

From Messrs. Downes & Davies, 1 and 3, Stanley Street, Liverpool, we have received a large wall sheet calendar with monthly slips for 1923.

Messrs. Francis Polden & Co., Ltd., 56, Cannon Street, London, E.C., have issued a "Crown" diary for 1923, with three daily engagement spaces per page. A good deal of general information is given, also an insurance coupon.

A small booklet of squared paper has been received from The Franco Signs, Ltd., of 25, Oxford Street, London, W.1, and refills are afterwards provided as required.

From Messrs. John Armstrong & Co., of Barton Square, St. Ann Street, Manchester, we have received a wall card calendar of convenient size for the year 1923. It has also a block of "Midget" daily date slips.

A bright desk calendar (red and gold) with monthly cards (and on the back a complete calendar for the year 1923) has been issued by Messrs. C. A. Besley, Bailey & Co., Ltd., of Hope Street Lane Works, Cardiff.

A wall calendar, with monthly tear-off slips, has come to hand from the Loughborough College, Leicestershire.

Messrs. Ruston & Hornsby, Ltd., of Lincoln, have issued a serviceable wall calendar with monthly date sheets, each of which contains a half-tone picture illustrative of the company's manufactures.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LXI. No. 313. December, 1922. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—This issue contains the inaugural address by the president, Mr. F. Gill, and the addresses of the chairmen of the following Centres and Sub-Centres:—Mr. F. Tremain, Western Centre; Mr. F. G. C. Baldwin, North-Eastern Centre; Mr. W. B. Woodhouse, North-Midland Centre; Mr. R. D. Archibald, Dundee Sub-Centre; Mr. B. Welbourn, Liverpool Sub-Centre; and Mr. W. Pearson, East Midland Sub-Centre; also the following papers:—"The Production of Noise and Vibration by Certain Squirrel-cage Induction Motors," by Mr. F. T. Chapman; "An Electrical Timing Device for Short Intervals," by Prof. D. Robertson and Mr. N. F. Frome; "The Engineer and Manufacturing Costs," by Mr. F. C. Lawrence; "The Testing of Materials," by Mr. C. Dawson; "Observations of the Field Strength of Horsea Wireless Station," by Mr. E. B. Moullin; "Telephonic Repeaters and Long-distance Telephony," by Mr. J. A. Cooper; and "Automatic and Semi-Automatic Railway Signalling," by Mr. H. S. Petch.

"Steam Vessels" (60 pp.). Manchester: The National Boiler and General Insurance Co., Ltd. Price 2s.—This is a copiously-illustrated treatise upon the design, construction, and working of vessels subjected to steam pressure, pipes, valves, &c.

The current number of the *Decimal Educator* (The Decimal Association; 6d.) contains an account of the general meeting, including the report of the activities of the Association during the previous year presented to the members. The president's inaugural address, sundry items of interest from the U.S.A., and reviews of several books make up a more than usually interesting number.

"The Henley Manual" (190 pp., illustrated). London. Messrs. W. T. Henley's Telegraph Works Co., Ltd. Price 10s. 6d.—This is a reference book of convenient size, which should prove of service to all concerned with transmission systems. It is divided into five sections. Part 1 (66 pp.) gives useful formulæ and data of conductors, and includes wire gauge comparisons, overall diameters of standard types of cables, &c. Part 2 reproduces the Standard Specification for insulated cables. Part 3 deals with underground systems—direct, solid, and duct—and embraces protective systems and colliery installations. Part 4 treats of overhead construction, giving B.O.T. (Ministry of Transport) and Post Office regulations, notes on erection, sag, &c. The last part (36 pp.) describes various types of cable—v.i.r., v.b., paper, &c.—and concludes with sketches and descriptions of cable accessories. A comprehensive index and several pages of decimal-squared paper complete the volume.

"The Henley Telegraph," December, 1922. Price 6d. net.—The quarterly staff magazine of Messrs. W. T. Henley's Telegraph Works Co., Ltd., is, as usual, full of bright articles and notes, and the issue has been enlarged. An account of a presentation to Sir George Sutton, Bart., occupies several pages, and notes of recent important contracts appear.

"The M. & C. Apprentices' Magazine," Christmas Number, 1922. Glasgow: Messrs. Mavor & Coulson, Ltd. Price 4d.—A number of interesting articles and pictures are embodied in this issue, including "The Unemployed Employer," by Mr. Sam Mavor.

"The Brown, Boveri Review," November, 1922. London: Messrs. Brown, Boveri & Co., Ltd.—The two articles contained in this issue are "The Behaviour of Metals subjected to Mechanical Stress," and "Disturbances in Electrical Plants due to Lightning." Both are well illustrated. The latter article is based on an analysis of 33 failures due to lightning in transformers, generators, and other parts of installations.

"The Practical Engineer Electrical Pocket Book and Diary for 1923." London: H. Frowde and Hodder & Stoughton. Price 2s. 6d. net.

"Electric Power Plant Engineering," by J. Weingreen, Third edition. Pp. xi+511; 305 figs. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

South African Railways and Harbours Magazine, Christmas, 1922. Price 2s. 6d.—This is a bulky issue, containing numerous good stories and pictures.

"Internal-Combustion Engines," by J. O. Kill. Pp. xi+126; 27 figs. London: Sir Isaac Pitman & Son, Ltd. Price 3s. net.

The Portuguese Electrical Market.—Although the Portuguese market for electrical goods is not among the most important, it is yet by no means one to be neglected. The city networks of Lisbon and Oporto are growing concerns, and many industries which had their own electrical installations have found it better to become customers of the municipalities.

Of electrical material Portugal makes only porcelain (for switches); the rest of her wants must be satisfied from abroad. Quite lately the customs tariff has been raised; but whereas increases have been numerous in the bulk of the imports, those of electrical material have been reduced. Thus, since the beginning of this year, the customs charges on dynamos, motors, and transformers have been reduced as follows: Up to 50 kg., 6 centavos per kg.; from 50 to 100 kg., 5 centavos; 100 to 500 kg., 2 centavos.; 500 to 1,000 kg., 3 centavos; and beyond 1,000 kg., 4 centavos.

The countries of origin of the imports are at present about as follows: Dynamos, alternators, and commutators: America, Switzerland, Germany, Belgium (a few). Static transformers (over 2,000 kVA): America, Belgium, Hungary. Motors: Germany and France. Meters: France (for the most part), Germany, Switzerland. Lamps: Holland, Germany, and France. Armoured cables: Germany, Italy, and France. Rubber-covered wire: Germany, Italy, Spain, France, and Belgium. Smaller apparatus: Germany, Switzerland. Household apparatus, electric irons, fans, &c.: Germany, France, and Spain.—*L'Electricité pour Tous.*

Inquiries Regarding Trade with Argentina.—Mr. H. O. Chalkley, H.M. Commercial Secretary at Buenos Ayres, will be in attendance at the Department of Overseas Trade for a few days from January 18th, and will be pleased to interview manufacturers and merchants interested in trade with Argentina. Applications for interviews should be made not later than January 17th to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Manchester Engineering Trade.—At the annual meeting of the Manchester District Engineering Trades Employers' Association, in the Memorial Hall, Manchester, Mr. Joseph H. Stubbs was re-elected president for the second year, and Mr. F. C. Gibbons vice-president. Alderman F. J. West was reappointed treasurer. Contrary to the experience of twelve months ago, there is at present no outstanding difference in the engineering trade with the trade unions. Whilst the industry in the Manchester district cannot be said to show very marked signs of reviving trade, the tendency is no longer steadily downward. "It could not be definitely proved," declared one employer, "that the upward curve has arrived, but many of us are of the opinion that the bottom has at last been reached."—*Manchester Guardian.*

German Export Duties.—*The Deutsche Allgemeine Zeitung* learns from a reliable source that the Export Duty Committee of the Provisional Economic Council, in view of the situation of export business, has decided unanimously in favour of a reduction of the supplement of 30 or 60 per cent. in force since September 3rd, 1922. Owing to the reaction in the exchange rate a reduction in the supplement has become an urgent matter for German industry. The journal understands that the reduction will apply to nearly all articles appearing in the tariff.—*Reuter's Trade Service* (Berlin).

The A.E.U.—The December *Journal* of the Amalgamated Engineering Union contains a review of the year's developments and activities. The year commenced with a total membership of 409,219, but this has fallen to 357,871—a decrease of 12.8 per cent. It is considered that the decrease is due to the gradual "deflation" of the numbers which entered the various branches of engineering industry during the war. Prior to the war the members numbered less than a quarter of a million. It is stated that probably the only way in which the loss will be made up will be the re-admission of former members who have left for economic reasons.

Bulgarian Government Contracts.—We understand that on various occasions British firms have approached the Department of Overseas Trade respecting the conditions of payment, inspection, &c., attached to the submission of tenders for material required by the Bulgarian Government. British firms have in general found these conditions difficult, and firms have in some cases submitted tenders on terms other than those stipulated by the Department of the Bulgarian Government concerned. The Secretary in charge of Commercial Affairs at H.M. Legation at Sofia has now called attention to this practice, and has pointed out that it is useless to submit offers which do not comply with the conditions laid down by the Bulgarian State Departments. He states that it is impossible to induce the Bulgarian Government to vary these conditions so long as competing firms of foreign nationality are prepared to accept them, as is at present the case. Particulars of the general conditions can be ascertained at the Department of Overseas Trade. The Commercial Secretary strongly recommends that such British firms as are desirous of submitting tenders should appoint agents in Sofia provided with powers of attorney to sign eventual contracts in their name. The Department of Overseas Trade is prepared to advise firms in the appointment of representatives who could be instructed in case of need by telegraph in the event of a favourable opening presenting itself.

The British Empire Exhibition.—The Duke of Devonshire, the chairman of the Executive Council of the Exhibition, has given the following undertaking:—

"Provision will be made in all contracts and in every other way possible for Empire materials only to be used in the construction of the Exhibition buildings, and for Empire products only to be used in the restaurant, and no exception will be made unless it is certified by the British authorities and the Dominion representatives that such Empire products are not available."

The inquiry by Sir W. Joynson Hicks is still proceeding, as there are several other matters upon which criticism has been offered.

Local Exhibitions.—The Edinburgh Corporation Electricity Committee has decided to take a stand at the second Scottish Ideal Homes Exhibition which is being held in the city from January 31st to February 14th.

East Anglian Electricity, Ltd., of Felixstowe, Stowmarket, &c., recently held an electrical exhibition at their Beccles (Suffolk) branch. Demonstrations of cooking were given, using ovens by the General Electric Co., Ltd., Belling & Co., and also with the "Lightning" oven invented by Mr. Napier Prentice, which is so constructed that the whole oven is bodily raised on a counterweight when inspecting the progress of cooking, thus conserving the heat when the oven is open or raised. Demonstrations were also given with a "Eureka" vacuum cleaner notable for its small compass. Demonstrations were given by the Singer Sewing Machine Co. with electrically-driven sewing machines. Labour-saving apparatus for all purposes was shown. The local manager, Mr. Sharratt, reports satisfying results, and hopes to repeat the exhibition on a larger scale again next spring.

E.D.A. Activities.—The latest publication of the Electrical Development Association (E.D.A. 330) gives advice upon the cleaning of aluminium saucepans and the better advice to "Use Electricity for the Cooking of Food."

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Individuals and firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below. In the case of foreign firms, the name and address of the British representatives to whom objections, if any, are to be sent are also given.

Aeriola. No. 426,513. Class 8. Apparatus for wireless telegraphy, wireless telephony, radio instruments, and parts thereof.—The Aeolian Co., Ltd., Aeolian Hall, 131-137, New Bond Street, London, W. December 20th, 1922.

Magnavox (lettering and design). No. 429,679. Class 8. Electrical sound amplifying devices, loud-speaking telephones, aircraft telephones, audion-frequency amplifying cabinets, &c.—The Magnavox Co., 2725 East 14th Street, Oakland, Cal., U.S.A. (Feeny & Feeny, 73a, Queen Victoria Street, London, E.C.) December 20th, 1922.

Iris (lettering and design). No. 430,209. Class 8. Instruments for use in wireless telegraphy and telephony.—Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, London, W.C. December 20th, 1922.

Bell-Blazo. No. 430,392. Class 13. Gas and electric metal fittings.—George Abel-Harry, trading as the Gordon Bell Co., 131, Essex Road, Islington, London, N.1. December 20th, 1922.

Lucifer. No. 426,455. Class 18. Magneto electric lighting sets.—La Société des Magnetos Lucifer, 14, Rue de St. Julien, Carouge, near Geneva, Switzerland. (Haseltine, Lake & Co., 28, Southampton Buildings, London, W.C.) December 20th, 1922.

Metrovick. No. 428,500. All goods in Class 40.—Metropolitan-Vickers Electric Co., Ltd., 4, Central Buildings, Westminster, S.W. December 20th, 1922.

A Telephone Card.—In accordance with its usual practice, the County of London Electric Supply Co., Ltd., has sent us a card for recording telephone numbers. This year's illustration depicts a family group basking in the rays of an electric fire.

The Human Thermostat.—Messrs. George Nobbs, Ltd., have sent us a neat little thermometer for use where their "Genii" radiators are employed. The instruction is to economise electricity by switching off one or more of the radiators when a "healthy temperature" is indicated on the thermometer—namely, 60 to 65 deg. F. for living rooms, 50-55 deg. for bedrooms, and 60 deg. for nurseries. The idea is excellent; the Genii radiator supplies the heat, the Genii thermometer indicates the temperature, and the *genius loci* performs the functions of automatic switchgear.

South African Railway Electrification.—The Steelwork Contract.—The latest *Bulletin* of the General Manager of Railways states that the erection of locomotives will take place at Maritzburg, and as far as possible certain of the labour will be supplied by the administration. In the case of the overhead equipment of the permanent way, labour will also be supplied as far as possible by the administration. Arrangements have been made for the use of South African manufactured steel for the structures for the overhead equipment of the permanent way. Negotiations have been completed with the Union Steel Corporation of South Africa, Vereeniging, in conjunction with Messrs. Gilbert Hamer & Co., Durban, for this work, and it is anticipitated that the contract will shortly be signed. Over 3,000 tons of South African manufactured steel will be used in connection with this contract. The number of European employés at the Union Steel Works, Vereeniging, will be increased by about 18 per cent., while the joint contractors (Messrs. Gilbert, Hamer & Co.) will require to double the number of mechanics employed at their works. The Union Steel Corporation will purchase, in connection with this contract, from 1,000 to 2,000 tons of scrap from the administration's stocks at Durban. The *Bulletin* says that the erection of the steel frame power house buildings will be carried out entirely by South African labour by Messrs. Wade, Dorman & Co., Durban; the provision of quarters for the power station staff at Colenso has been authorised and work commenced. The contractor's engineers for the overhead equipment of permanent way have arrived in South Africa and preliminary work is in progress. Certain alterations to sidings and signals at various stations on the section to be electrified will shortly be put in hand. All contracts provide for the use of South African material and labour wherever this is practicable and reasonably possible.—*South African Mining and Engineering Journal.*

French Telephone and Cable Manufacture.—The report of the Société Industrielle des Téléphones states that the company was able to traverse the industrial crisis in 1921-22 without having been specially affected by it; with the exception of the telephone department all the works had been provided with sufficient orders to maintain normal working. As the Administration of Posts, Telegraphs and Telephones did not obtain the credits necessary for developing and improving the equipment, no orders had been placed by that department, with the result that the telephone manufacturing industry had been completely paralysed. There was, however, reason for believing that some of the schemes before the Chamber would be adopted shortly, and that large orders would result to the works producing cables and telephone apparatus. Since the beginning of the new financial year the company had acquired works at Berzons adjoining its cable factory and works at Clichy. It was proposed to transfer the manufacture of telephone cables to the new shops at Berzons and to produce technical rubber products at Clichy. After having made provision for depreciation, the accounts show net profits of 5,125,000 fr. for 1921-22, and a dividend at the rate of 45 fr. per share has been declared, compared with 40 fr. in 1920-21.

Protection in Finland.—The Finnish Electrical Co. (Gott. Stromberg) has made application to the Council of State asking for the protection of the native industry by an increase from the present 10 per cent. ad valorem to 25 per cent. in the duties on small electrical machines up to a maximum weight of 10 cwt. It is pointed out that although the difficulties in the Finnish electrical industry would not be entirely overcome by the suggested augmentation, the latter would render it possible to compete with foreign industry in the production of the machines in question.

Electricians' Wages.—The National Joint Industrial Council for the Electricity Supply Industry has decided that the present sliding scale agreement bearing upon the wages of electricians, mechanical fitters, &c., shall be continued for one calendar month from January 1st, and that the employers and/or employés on each District Council shall have the right to put forward the schedules of wages which they consider equitable to their respective District Councils. These proposals are to be in the hands of the district secretaries by January 6th, and if no agreement is reached by January 13th the points of disagreement shall be submitted to the N.J.I.C. at a special meeting on January 19th. Any points undecided at this meeting will be referred to the Industrial Court which will sit locally.

Dust-Removing Plant.—At the recent annual meeting of the British Vacuum Cleaner & Engineering Co., Ltd., the chairman made mention of the plant installed at the Gennevilliers power station for the removal of dust accumulations in boiler and economiser chambers and flues without shutting down the boilers for the purpose. This, the first of its kind, had proved so satisfactory that the Union d'Electricité had placed a further substantial contract with the company.

Swiss Aluminium Industry.—In an article in the *Bulletin* of the Swiss Electrical Engineers' Association the following particulars are given regarding the Swiss aluminium industry. From 10,000 tons per year in 1913, the Swiss output rose to 15,000 tons in 1917 and 1918, or an increase of 50 per cent. The share of Switzerland in the world's output was, in 1914, 11.75 per cent.; in 1921, 8.68 per cent.; and this year it is reckoned it will only be 5.85 per cent.

Unemployment.—The Employment Exchange returns for the week ended December 18th show that the number of unemployed was smaller by 29,541 than in the preceding week. The total was 1,359,100, and there were 54,700 workers on short time as compared with 54,927 on December 11th.

At the end of November the number of unemployed in the engineering and shipbuilding trades was 123,894, or 27.3 per cent. of the membership of the trade unions represented.

Wage Reductions.—The December *Ministry of Labour Gazette* records the wage reductions which have been effected during the first eleven months of the year. The total weekly sum involved is £4,170,100, and this affects 7,456,000 workpeople. On the other hand, there has been a total increase of £11,400 weekly distributed among 73,600 persons. In the engineering and shipbuilding industries the number of people affected is 1,305,000, the total weekly reduction mounting to £1,178,200.

German Competition in Argentina.—It is well to draw attention to a statement which was made by the chairman of the London & River Plate Bank in the course of his address to the shareholders at the annual meeting on December 19th. Speaking of Argentina, he stated that industrialism is becoming steadily developed, and a feature of this is that most of the machines imported are sent from Germany. The machines are usually of light power, electrically driven, and capable of being easily tended by technically unskilled labour.

Metropolitan-Vickers New Showrooms at Birmingham.—The Metropolitan-Vickers Electrical Co., Ltd., recently opened new showrooms and a sales depôt at Daimler House, Paradise Street, Birmingham. The premises are conveniently situated near the Town Hall and the General Post Office, and close to the industrial and shopping centres and railway stations. The large rooms, which are distinctive by reason of their dignity and artistic finish, contain a well-selected stock of high-class electrical fittings and domestic appliances. The stores, situated in the basement, carry a very large stock of domestic heating and cooking apparatus, lamps and fittings, and there is also an industrial showroom where the firm demonstrates in a very effective way the industrial application of electricity. An old-established firm of brassfounders—Messrs. Harcourts, Ltd.—is one of the firm's subsidiary companies, and the latest ideas are exemplified in artistic and well-designed electric bowl pendants, lamp standards, candle brackets, push buttons, tumbler switches, and many other articles in cast and pressed metal work. Messrs. Harcourts have a capable staff of modellers, and the hope is entertained that architects and others on big undertakings will consult the firm in relation to ornamental or special designs. On the domestic side, a model electric kitchen has been constructed, and at this demonstrations will be given showing the advantages of cooking by electricity. The kitchen equipment appears well selected to suit the average small household, where labour saving and economy are of importance; and examples are also shown of "Cosmos" domestic appliances. A 2-kW fire of new design is exhibited in various "periods." A model is shown also of the firm's broadcasting station at Trafford Park, and receiving sets and equipment are prominently displayed.

The Peruvian Market.—A large demand for electrical machinery and plant is reported to have existed in Peru for some months past, particularly in view of the intention to utilise the water powers of the country. Old machinery in the sugar mills is being replaced by electrical plant, and important orders for generators, motors, &c., are said to be in prospect in the near future.

Holidays.—The works of Messrs. Daniel Adamson and Co., Ltd., will be closed from to-day, December 29th, until Tuesday next, January 2nd, for the New Year holidays.

Vulcanised Fibre.—The Board of Trade Committee formed in May last, in accordance with the Safeguarding of Industries Act, to investigate complaints made by the B.E.A.M.A., on behalf of Messrs. Sutcliffe, Ltd., that American vulcanised fibre was being sold in this country below the British production cost, has issued its report. It was stated in evidence that there was an agreement in existence between importers and certain British manufacturers fixing the selling price of the American product at 1s. 7d. per lb. Messrs. Sutcliffe were not a party to this agreement, but admitted that they could not complain so long as this price was maintained. However, they asserted that there had been evasions. The Committee considers that no serious evasion has been proved, and recommends that no action shall be taken.

Indian Trade in October.—H.M. Senior Trade Commissioner in India (Mr. T. M. Ainscough, O.B.E.) has forwarded to the Department of Overseas Trade a note issued by the Director of Statistics relating to India's overseas trade during October, 1922, in which he says that the trade returns of British India for the month showed an improvement in the values of imports and exports as compared with the preceding month. As compared with October, 1921, the imports of food, drink, and tobacco decreased by Rs.1,87 lakhs, and raw materials by Rs.60 lakhs, while manufactured articles rose by Rs.2,19 lakhs. Of manufactured articles, the imports of cotton piecegoods increased in quantity and value, but there were decreases under railway plant and rolling stock (Rs.68 lakhs) and electrical instruments (Rs.13 lakhs), while all other important items in this group showed an improvement.

Commercial Fair in Madagascar.—The British Chamber of Commerce in Paris learns that the first official Commercial Fair (samples) is to be held at Antananarivo (Tananarive) from August 15th to September 15th, 1923. The fair will be held under the auspices of the Government of the Colony, and British firms will be permitted to exhibit. The exhibits will comprise machines and machinery, oils, metallurgical products, hardware, textiles, china and glassware, foodstuffs, and various general merchandise. Full information concerning the fair can be obtained from the British Chamber of Commerce at Tananarive.—*Reuter's Trade Service* (Paris).

Patent Restoration.—An order has been made restoring Patent No. 148,524 of March, 1918, granted to Gesellschaft für Drahtlose Telegraphie m.b.H. for "Improvements in electric conducting coils."

Social Events.—The Social Club in connection with the Midland Electric Manufacturing Co., Ltd., held its annual Christmas dinner and concert at the White Horse Hotel, Birmingham, on December 20th, Mr. W. L. Barber presiding. Nearly 150 members of the works and staff were present, and the musical programme was entirely provided by members.

The Osram and Robertson Club is holding a dance at the Osram-G.E.C. Lamp Works, Hammersmith, tomorrow evening, and a long and varied programme has been received from the secretary, Mr. E. V. Vanhinsbergh.

Industry in the United States.—According to *Power*, there are numerous indications of a revival in industry throughout the United States. Twelve of the fourteen principal groups into which industry is divided show increased employment, and among these are the iron and steel, non-ferrous metals, and vehicle industries. Fifty-six of the principal cities report a diminution of unemployment, and the returns from New York State are most encouraging. It is stated that business in Chicago has reached the largest volume since the spring of 1920.

LIGHTING AND POWER NOTES.

Abergele.—Electricity Supply.—The Urban District Council has received a report from the North Wales Power Co. regarding a proposed electricity scheme. The company stated that the transmission lines would be ready in the course of three months, and that it would erect a transforming station at the company's expense at the nearest point to Abergele. The cost of the scheme to the Council would be £10,000, and the company was prepared to supply electricity at £6 per kW plus ¼d. per kWh on the Council's output. The Council has decided to obtain expert advice on the scheme.

Almondsbury.—Electricity Supply.—The Electric Light and Supply Co. has applied to the Parish Council for permission to erect poles for overhead mains for supplying electricity to the district. The Council has decided to raise no objection provided the poles are erected at certain points.

Amesbury.—Inauguration of Electricity Undertaking.—The electricity undertaking was formally opened on December 8th by Mr. H. C. James, managing director of the Amesbury Electric Light & General Supply Co.

(*Continued on page* 982.)

THE LEICESTER ELECTRICITY UNDERTAKING.

INAUGURATION OF NEW STATION.

The formal opening of the new electricity generating station at Leicester on December 8th, 1922, followed closely upon the completion of the first year in which the electricity supply department of the city was governed by a committee separately appointed to control this most important branch of the City Council's activities.

The Corporation first undertook the supply of electrical energy in 1894, when the Aylestone generating station was erected on the gas works site and supplied single-phase current, principally for lighting purposes. The late Mr. Alfred Colson acted in the dual capacity of gas and electric lighting engineer, and the Gas and Electric Lighting Committee continued in charge up to the end of 1910, when it was relieved by the Tramways and Electricity Committee.

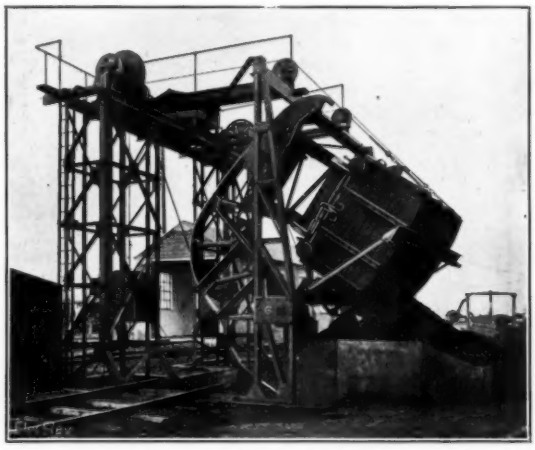

Fig. 1.—Coal Wagon Tippler.

However, in 1904, the Tramways Committee had erected its own generating station at the Lero for the purpose of giving a d.c. supply to the tramway system established in that year. From this station, in 1908, the first serious attempt was made, under the direction of Mr. T. R. Smith, M.I.E.E., to meet electrically the demand for motive power, and the expedient of connecting power consumers to the 500-volt d.c. mains proved successful. In 1911 electricity supply was placed under the sole management of Mr. Smith, and it soon became necessary to supplement the plant both at the single-phase Aylestone and at the Lero d.c. stations. Three-phase turbo-alternators were installed from time to time at both works, and in 1917 the services of Mr. C. H. Wordingham, C.B.E., M.I.E.E., were enlisted with a view to the preparation of a scheme for extending the electricity supply. Although the war prevented the realisation of the project, a number of Mr. Wordingham's recommendations were embodied in the scheme ultimately carried out, and the result of Mr. Smith's visit to the U.S.A. is shown in the design of the new station in the Freemen's Meadow, Aylestone.

The progressive policy of the department is evidenced by the new showroom in Market Street. The number of lighting consumers at the end of 1922 was nearly 9,000, while motors developing well over 25,000 h.p. consumed some of the 29 million kWh that had been generated up to October this year.

Fig. 6 shows the site of the new station on the right bank of the canalised River Soar, on which work was started in May of last year. The main contract was awarded to the English Electric Co., Ltd. The boiler-house equipment and the whole of the pipework were entrusted to Messrs. Babcock & Wilcox, Ltd., while the coal and ash-handling plant and wharf construction were placed in the hands of the Mitchell Conveyor and Transporter Co., Ltd. The portion of the station now completed accommodates one 10,000-kW turbo-generator, with the necessary steam-raising and auxiliary plant, but a total capacity of 65,000 kW is aimed at.

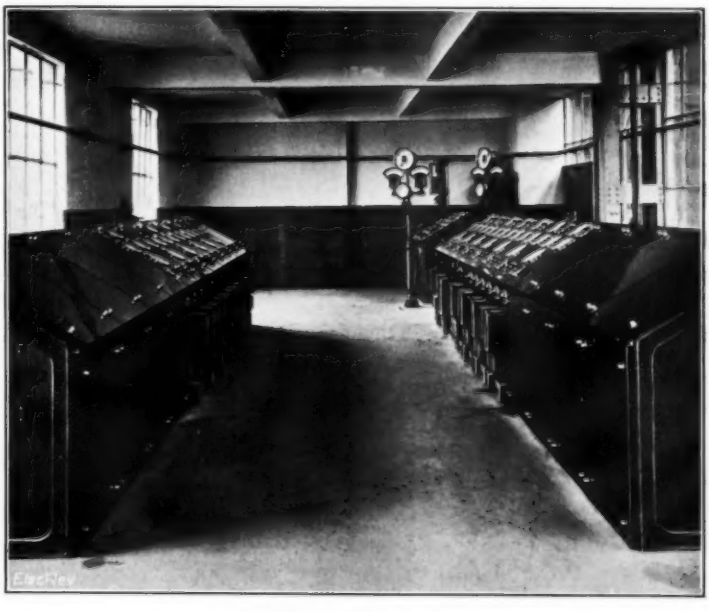

Fig. 2.—Control Room.

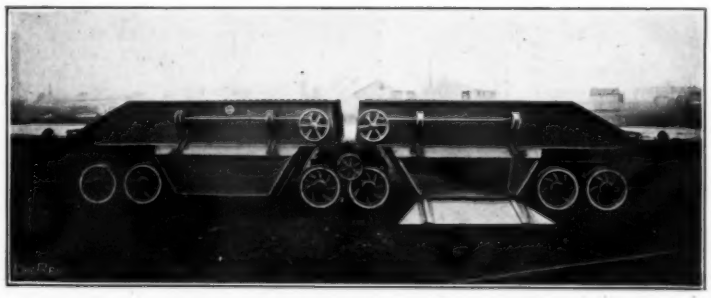

Fig. 3.—Ash Wagons.

Rail-borne coal is unloaded by a "Mitchell tippler," fig. 1, operated by a 10-h.p. motor, which device consists of a cradle which rotates and carries the wagon with it and discharges its contents into a hopper underneath. The whole operation of tipping and returning the wagon takes less than two minutes. River-borne coal is unloaded by means of a grab-crane into railway

trucks, which are then dealt with by the tippler. The coal is raised by means of a skip-hoist, and distributed by a belt conveyor into the bunkers. The ashes fall into hoppers, so that ash wagons, fig. 3, of special design,

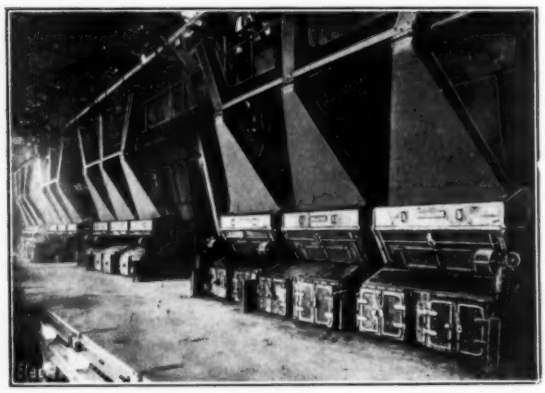

Fig. 4.—Leicester Boiler House.

but of standard railway gauge, can be run underneath.

The four Babcock & Wilcox boilers, fig. 4, each have a steaming capacity of 45,000 lb. per hour at a pressure of 275 lb. per sq. in., superheated to a total temperature of 700 deg. F. Each is fitted with an integral superheater and superimposed steel tube economiser. There are three mechanical stokers to each boiler, of the chain-grate type, designed to burn low-grade coal under balanced-draught conditions or on natural draught when higher-grade fuel is used.

The 10,000-kW impulse turbine, fig. 5, is coupled to a 6,600-volt, 50-period, 3-phase alternator supplied with cooled air from a closed-circuit air cooler installed immediately below in the concrete foundations, and the steam, after being condensed, is passed to the boilers on what is known as the "closed feed" system; a Prache and Bouillon automatic self-cleaning evaporating plant is provided for supplying distilled water at the rate of three tons per hour for the make-up feed, consisting of an automatic self-cleaning double condenser, pre-heater, thermo-compressor, accessories, and the necessary electrically-driven pumps. The condenser, as well as its auxiliary pumps, was supplied by Messrs. W. H. Allen, Son & Co., Ltd., and contains 6,030 brass tubes each $\frac{3}{4}$ in. in diameter and 15 ft. long.

The circulating water is passed through disk-type self-cleaning water screens manufactured by Messrs. F. W. Brackett & Co., Ltd. Each of the two screens is capable of dealing with two and a-half million gallons of water per hour, and is complete with the necessary pumps for producing the jets of water for cleaning. The capacity of this and the coal-handling plant is sufficient for a further 10,000-kW generating set when installed.

The whole of the high-pressure switchgear is in a separate building, and the oil switches are operated by electrical means from the control room, fig. 2, in an annexe to and overlooking the turbine room. The e.h.p. switches are arranged in separate cubicles, each provided with a pair of iron doors in the external walls of the building through which alone access can be obtained.

The whole of the switchgear was supplied by the English Electric Co. The new station, which has cost nearly £500,000, may ultimately constitute an important link in the general scheme of electricity supply for the East Midlands Electricity District, the idea having been propounded (although nothing upon that score has been yet definitely settled) that a connection may with advantage be established between Leicester, Derby, Nottingham, and other towns, the whole matter being now under review by an Advisory Committee. At Derby important works have been quite recently completed, and although the larger project which is now in progress in Nottingham cannot possibly be finished for a considerable time, substantial progress in the matter is being made in the metropolis of the lace industry.

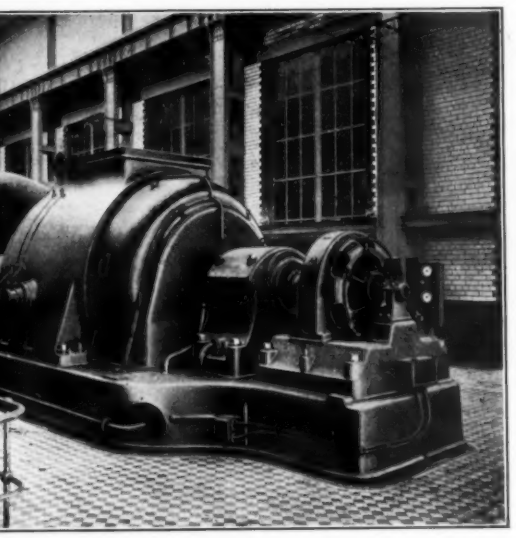

Fig. 5.—English Electric 10,000-kW Turbo-Generator.

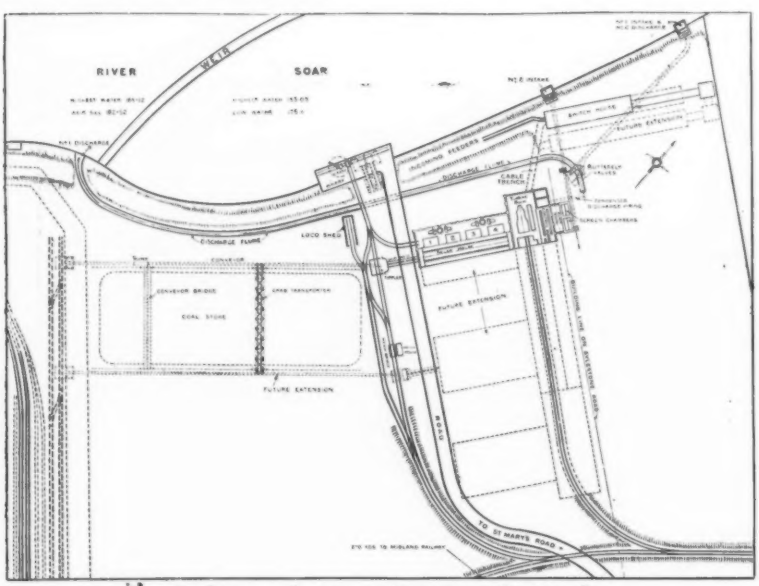

Fig. 6.—Plan of Leicester Generating Station Site.

There was a large and representative gathering at the opening ceremony, among the visitors being Ald. E. Huntsman, chairman of the Joint Electricity Board of the East Midlands Electricity District. Ald. E. Flint, chairman of the Electricity Committee.

on behalf of the Committee and the Corporation, thanked the Electricity Commissioners for the assistance which they had afforded. From its central position, and connected as it was with four main lines of railways, there was every reason to anticipate Leicester's further prosperity. The maximum power of the works in 1914 was 7,300 kW; this, he said, had risen to 24,250 kW. It used to entail 7½ lb. of coal to produce 1 kWh of electricity, but the amount of coal needed had been reduced to from 2½ to 3 lb., and might possibly be further reduced by the new plant. The domestic load, if properly treated, might become as great as the power load. The Committee had submitted a scheme to the Corporation with regard to this aspect of the matter, and the Corporation had given it its strong approval.

Mr. T. R. Smith, City Electrical Engineer, referring to the visit which he paid to America, at the request of the Committee, observed that whilst the generating stations which he had the opportunity of inspecting there were necessarily all on a large scale, it was not in that respect they excelled, but in their elaborate system of boiler-house control, and in that sense an endeavour had been made to follow their example in the new Leicester works.

THE WALSALL ELECTRICITY UNDERTAKING.

INAUGURATION OF NEW PLANT.

The Walsall Corporation was granted a Provisional Order to supply electrical energy in 1890, and the undertaking was commenced in 1895.

In 1913-14, upon the advice of Mr. E. M. Lacey, M.I.E.E., the Corporation decided to provide a new generating station at Birchills, and to change over to a 6,600-volt, three-phase system. The work was commenced in 1914, at which date Mr. H. A. Howie, M.I.E.E., was appointed engineer and manager of the undertaking.

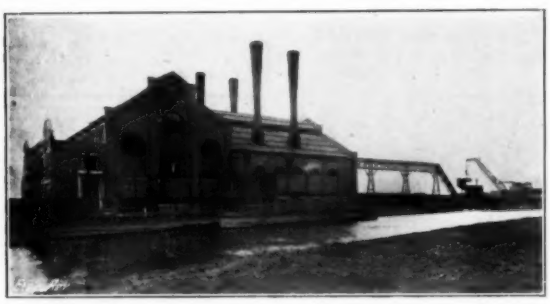

Fig. 1.—Birchills Generating Station, Walsall.

A popular feature was the application of a bulk supply two-part tariff for medium-pressure supplies to factories with a demand of not less than 20 kW. The method of measuring the maximum demand is of interest in that it is designed to give the consumer the benefit of a high power factor and *vice versa*. In 1921-2 the net number of consumers was 2,108, the total connections representing 14,948 kW, and the capacity of the station being 13,000 kW. The total cost per kWh sold, including capital charges, was 2.47d., the total amount

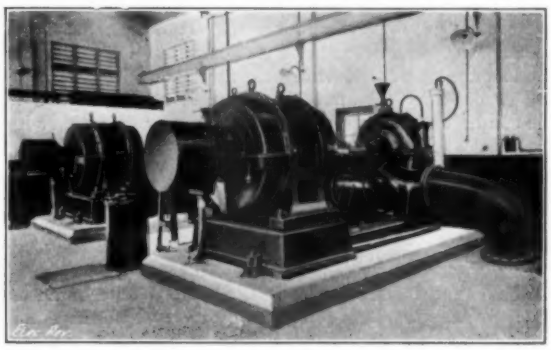

Fig. 2.—The Anson Pumping Station.

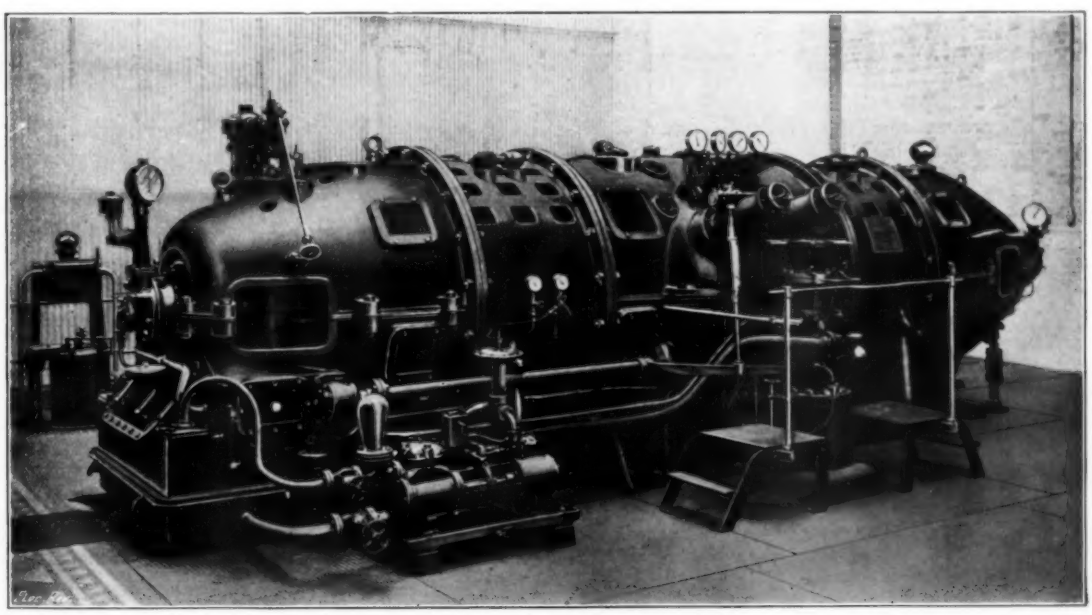

Fig. 3.—A 5,000-kW Brush-Ljungstrom Turbo-Alternator.

of energy sold being 8,095,885 kWh and the maximum load 4,050 kW.

In South Staffordshire there are no large rivers, so the Birchills station was erected on the Wyrley and Essington branch of the Birmingham Canal Co.'s system, and

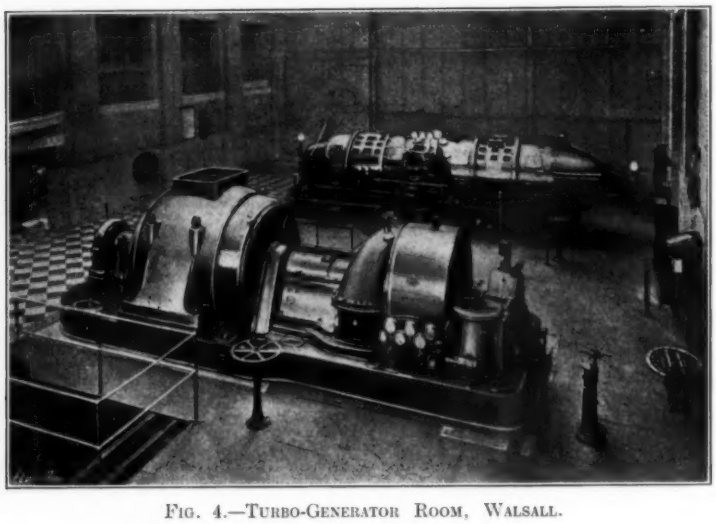

Fig. 4.—Turbo-Generator Room, Walsall.

the cooling water for condensing purposes has, up to a recent date, been taken from this canal. With this water the efficiency of the station was, as in shown by Table I, p. 981, considerably above the average, having regard to the conditions of load. However, in order to further increase the efficiency and to provide for the rapidly increasing load, provision was made for obtaining a considerably larger volume of cooling water by means of the Anson pumping scheme, which is an important feature of the extensions that were officially inaugurated on December 15th.

The canal is on what is called the Wolverhampton level, approximately 63 ft. above the level of the canal system through Walsall. In order to maintain the water at the Wolverhampton level, the Canal Co. has found it necessary to raise continuously a large quantity of water from the Walsall level. These pumping operations have, on occasions, interfered with the flow of the canal at Birchills so as to cause the high-temperature water from the condenser discharge to bank up to the inlet, thereby raising the temperature of the inlet water, and thus reducing the vacuum.

Therefore the Corporation undertook to raise from the lower canal level all the water required for the higher level canal, and for these services an annual sum is payable by the Canal Co. The agreement also provides for the Corporation to pass the whole of this water through the condensers at Birchills for a small annual contribution. The total volume of water necessary to maintain the higher canal level is approximately 550,000 gallons per hour, which is more than sufficient for present condensing water requirements at Birchills. In addition, the Canal Co. has provisionally agreed that the Corporation may, as the necessity arises, pump up to 1,200,000 gallons per hour.

Fig. 5 shows a portion of the canal system at Walsall. The pumping station has been erected in the position shown on the Anson branch of the low-level canal system, and the high-temperature water discharged at the high level can flow back to the low level, either *via* the Walsall or the Wolverhampton Canal systems, the distance being approximately three and a half miles in either direction. Only part of the water discharged through the condensers at Birchills to the high-level canal system is returned as described above to the Anson branch. A large quantity is entirely passed away from the Walsall canal system to the Wolverhampton canal system, the water being made up by the admission of cold mine water to the low-level system.

The water flows to the pump house by way of an open concrete channel, at one end of which there is a circulating water screen supplied by Messrs. F. W. Brackett and Co., consisting of a perforated disk 20 ft. 4 in. in diameter, rotating at low speed, with cleaning jets, are arranged to wash away all débris collected on the mesh. The screen passes 1,500,000 gallons of water per hour.

The pumping station (fig. 2) consists of two Mather and Platt medium-lift circulating pumps, each capable of delivering 7,400 gallons of water per minute against a total head of 110 ft. when running at a speed of 980 r.p.m. Each pump is driven through a flexible coupling by a 330-h.p., three-phase, 50-period, 400-volt enclosed ventilated slip-ring induction Brush motor.

The transformers and e.h.p. switchgear at the pumping station were supplied by the Metropolitan-Vickers Co., Ltd., and the chlorinating plant by the Paterson Engineering Co.

The capacity of the Birchills station has been increased by the installation of a Brush-Ljungström turbo-alternator set (fig. 3), with a steam pressure of 180 lb. per sq. in. at the turbine stop valve, 245 deg. F. superheat, and exhausting into a vacuum of 28¾ in. The set is capable of an overload of 25 per cent., or

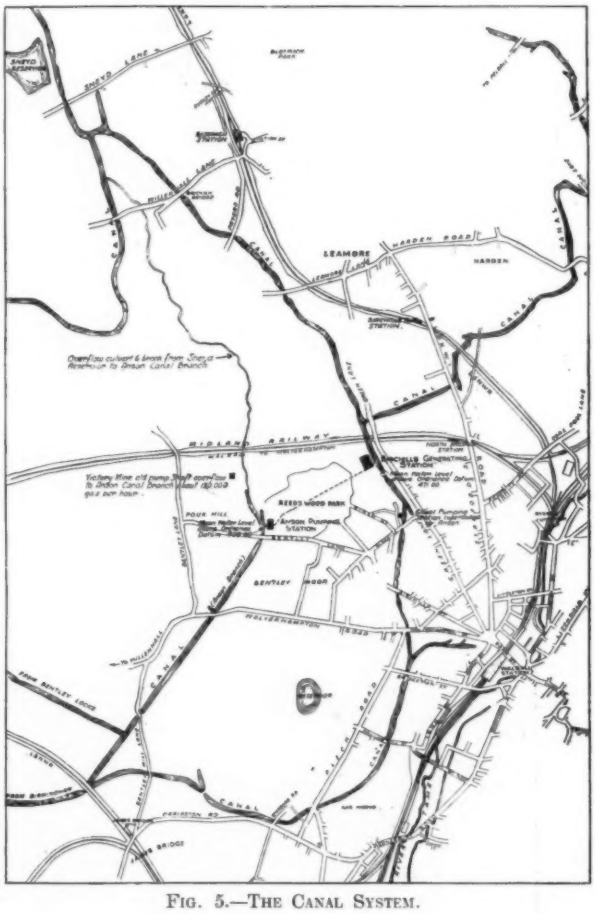

Fig. 5.—The Canal System.

6,250 kW, for a period of two hours. The two alternators have a combined output of 5,000 kW at 6,600 volts, three-phase, 50 cycles, 0.8 p.f.

The turbine is equipped with an auxiliary steam-driven oil pump, fitted with a Mason regulator set so as

to bring the pump into operation when the oil pressure of the main pump falls below a predetermined value.

The Brush surface condenser has a cooling area of 12,000 sq. ft., a capacity of 58,500 lb. of exhaust steam per hour, is supplied with 7,400 gallons of cooling water per minute, and is capable of maintaining a vacuum of 28¾ in. when the cooling water enters at a temperature of 60 deg. F.

The condenser auxiliaries comprise a four-throw Brush-Edwards air pump driven by a three-phase, 365-volt, 50-period, enclosed-ventilated Brush induction motor rated at 42 h.p., and a lift pump, driven off the air-pump crankshaft, pumps the condensate to the hot-well.

Cooling air for the alternators is provided by a Keith, Blackman fan driven by a 50-h.p. Brush enclosed-ventilated induction motor. The air is drawn through a Cleworth-Wheal wet air filter which is driven by the fan motor through spur gearing. The switchgear, comprising one generator and three feeder panels, was supplied by Messrs. A. Reyrolle & Co.

Before the Anson pumping scheme was put into operation, official trials of the turbo-alternator were made on May 23rd, 1922. The specified conditions upon which the contractor's guarantee of steam consumption was based were:—

Steam pressure at stop valve	180 lb. per sq. in.
Steam temperature at stop valve ...	625 deg. F.
Vacuum, with cooling water at 60 deg. F.	28.75 in.

Owing to the temperature of the canal cooling water being, on the date of the test, somewhat higher than that stated above, the vacuum was lower than 28.75 in., but the steam temperature was higher. After correction for these variations, the result of the trial was as follows:—

Table I.

	Steam Consumption in lb. per kWh.			
Load, kW	Vac., in.	Measured.	Corrected.	Guaranteed.
2,328	28.30	13.56	12.53	13.0
2,495	28.25	13.27	12.32	12.8
3,942	27.96	11.65	11.14	11.78
4,968	27.62	11.48	11.00	11.42
4,845	27.40	11.80	11.10	11.42

During the above series of tests, on loads ranging from 2,328 to 4,968 kW over a period of eight hours, the coal consumption was 2.26 lb. per kWh generated, the calorific value of the coal being 10,130 B.th.u. per lb. "as fired"; the thermal efficiency of the station was 14.85 per cent.

After the Anson pumping scheme was put into operation, further trials took place on November 22nd, 1922, and the following are the results obtained:—

Table II.

Load (average)	5,030 kW.
Steam pressure at turbine stop valve ...	166 lb. per sq. in.
Steam temperature at turbine stop valve	662 deg. F.
Vacuum (bar. 29.95 in.)	28.90 in.
Cooling water temperature:	
Condenser inlet	49 deg. F.
Condenser outlet	61 deg. F.
Condensate (average per hour)	52,100 lb.
Steam consumption (as measured) ...	10.36 lb. per kWh.

The test commenced at 10.30 a.m. and finished at 4.30 p.m., and during the trials the whole of the commercial load of the station was carried by the Brush-Ljungström set for a period of six hours. The load varied from 3,700 to 5,450 kW. The coal consumption was 1.92 lb. per kWh generated, its calorific value being 10,160 B.th.u. per lb. "as fired"; the thermal efficiency of the station was 17.49 per cent. No allowance on steam consumption was claimed by the makers for variation of load, and none is included in the above figures. The set has been in continuous operation since February, 1922. It was not overhauled or prepared for test prior to the trials being made.

As an indication of the performance of the plant over a weekly run, the actual recorded results for the weeks ending October 15th and November 5th, 1922, are given in Table III. They compare the performance before and after the Anson pumping scheme was brought into operation. During both weeks the Brush-Ljungström set only was running.

Table III.

	Week ending Oct. 15th	Week ending Nov. 5th.
kWh generated	252,540	285,840
Maximum load	3,200 kW.	4,100 kW.
Load factor	47%	41.5%
Temperature of cooling water	78 deg. F.	47 deg. F.
Coal consumed	301 tons.	299 tons.
Calorific value of coal ...	10,050 B.th.u. per lb.	9,910 B.th.u. per lb.
Coal per kWh generated ...	2.67 lb.	2.35 lb.
Thermal efficiency ...	12.7%	14.6%

It will be observed that the station was operating on a higher maximum load, but a lower load factor during the week ending November 5th than it was during the week ending October 15th. It may be thought that the excellent results are due to the high load factors. Therefore, to avoid any such misconception it may be pointed out that the annual load factor of the Birchills station on the same basis is about 30 per cent., and that in order to attain this figure, under the varying conditions of general electricity supply, the weekly load factors must necessarily vary between 40 and 50 per cent. However, the records show that under very similar load conditions the thermal efficiency of the station was 12.7 per cent. for the week ending October 15th, 1922, and that after the Anson pumping station was put into operation the efficiency improved to 14.6 per cent. in the week ending November 5th, 1922. This greatly improved efficiency is in itself a sufficient indication of the success of the scheme.

Since the inauguration of the Birchills station, a steady extension of the 6,600-volt, three-phase feeders, and also 4-core, 400-volt distributors, has been carried on, and a gradual change-over of distribution from d.c. to a.c. has been taking place. Many large works in the borough are now taking a supply from the e.h.p. mains, which have also been extended outside the borough, under Fringe Orders, in order to supply various collieries.

It may be mentioned that the whole of the e.h.p. mains have been supplied and laid by Callender's Cable and Construction Co., Ltd., and an interesting fact is that the 3,300-volt cables laid by this company some thirteen years ago, which worked at that pressure for some five or six years, have successfully withstood a working pressure of 6,600 volts during the past seven years without breakdown or trouble, although they were originally designed for the lower pressure.

In conclusion, it should be pointed out that the above-mentioned trials are of considerable value, inasmuch as the details are the first that have been published of this particular size and make of machine, and we are indebted to both Mr. Howie and the Brush Electrical Engineering Co., Ltd., for permitting them to be made public.

The extensions were inaugurated on December 15th by Mr. W. J. Talbot, ex-chairman of the Corporation Electricity Supply Committee and managing director of the Talbot Stead Tube Co.

Mr. W. T. Comer (vice-chairman of the Electricity Supply Committee) mentioned that the working costs had been brought down to the lowest pre-war figures. The total capital expenditure on the undertaking had been £355,366, and the outstanding debt was £299,310, in respect of which they had £36,116 in sinking fund.

Mr. E. M. Lacey (consulting engineer) said that in 1913 Walsall had an obsolete power station, obsolete plant, and an obsolete transmission system. The total capacity of the plant was only 2,500 kW, and the coal consumption amounted to 13 or 14 lb. per kWh generated. The plant capacity was now 13,000 kW, whilst the coal consumption had decreased to less than 2½ lb. per kWh generated. He anticipated that in the future working costs, including capital charges, would not exceed about 0.6d. per kWh. The total cost of the power station, after including the price of two more boilers, which were still required, would be between £13 and £14 per kW.

LIGHTING AND POWER NOTES.

(*Continued from page* 976.)

Canada.—Quebec.—The Montreal correspondent of the *Daily Telegraph* says that the Premier (Mr. Taschereau), of the Province of Quebec, recently announced the early commencement of one of the greatest hydro-electric works in the history of Quebec Province, including the damming of the discharge from Lake Saint John head-waters, on the Saguenay River, which would ultimately develop over 1,000,000 horse-power. Mr. Taschereau stated that the work of constructing the dam would be started as soon as possible, and the first part of the project would be completed within two or three years, at a cost of $12,000,000, for developing 200.000 h.p., while the rest of the scheme would be completed later, eventually producing 1,000,000 h.p. Mr. Taschereau, in explaining the economic advantages to the Province of Quebec of this large electrical development, stated that the production of the first 200,000 h.p. would mean the saving to the firm of Price Brothers, Quebec, alone of $1,500,000 annually spent on coal.

British Columbia.—The B. C. Electric Railway Co. is to erect an automatic sub-station this winter for the regulation of electrical energy distributed to Greater Vancouver, at a cost of $65,000.—*Reuter's Trade Service* (Vancouver).

Cardiff.—New Plant.—Mr. Morley New, the city engineer, recently presented a report to the Electricity Committee with regard to the proposed installation of new plant in order to meet future requirements. The report involved an estimated capital expenditure of £42,410 for new plant, extensions, &c., at the Roath power station and the Hayes sub-station, and the provision of a cooling tower with a capacity of 300,000 gallons per hour. This report was supplemented by a statement that the Great Western Railway Co. had definitely decided to install electrically-driven hydraulic pumps, and the communication of the chief electrical engineer of the company was looked upon, at his request, as an undertaing on the part of the company to take supplies from the Corporation for the plant. The proposal was to install 2,810 h.p., with the possibility of a further 650 h.p. shortly. Eventually the Chairman (Mr. G. Gough) and Messrs. E. Curran, F. Jones, and C. H. McCale were appointed as a special committee to report without delay on the whole question, in order that decisions might be taken by the City Council at the February meeting.

Carlisle.—New Power Station.—The City Council has decided to erect a new power station as the present undertaking is unable to meet the increased demands for electricity. The scheme was first considered three years ago, when the estimated cost of erecting the station was £200,000. Owing to the decrease in the cost of building, &c., it is now estimated that the cost will be £150,000.

Clacton-on-Sea.—Loan.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £8,000 for the installation of a Diesel engine and generator, together with cooling plant.

Continental.—Russia.—A movement is on foot to extend the Shatursk electricity works near Moscow. New district stations, running on local peat fuel, to economise petroleum, are required to meet the growing demand of Moscow for electricity.

Bavaria.—The Government has been voted a credit of 10 milliard marks for the construction of power stations. The total cost will be 21 milliard marks.

Denny (Stirlingshire). — Price Reduction.—The Town Council is reducing the charge for electricity for lighting from 7½d. to 7d. per kWh.

East Midlands Electricity District.—The scheme for the reorganisation of the supply of electricity in the above area previously submitted by the Conference of Municipal Electrical Undertakers has been modified, and the Commissioners give notice that they will hold a local inquiry at the Guildhall, Nottingham, on Tuesday January 23rd, 1923, at 10.30 a.m., and the following days, with reference to the modified scheme which provides for the formation of an Advisory Committee.

Copies of the said modified scheme may be obtained from W. J. Board, Esq., Guildhall, Nottingham, at a cost of 10s. each, and supplementary particulars in support of the scheme may also be obtained at a cost of 30s. each on application at the same address.

Irish Free State.—Swords (Co. Dublin).—The District Council has approved of a scheme for a public electricity supply, and has ordered application to be made for an Order and for sanction to a loan of £3,275 to meet the expenditure.

London.—St. Marylebone.—*Price Reductions.*—As, in spite of reductions in charges already made, the year's net profits from the electricity undertaking is likely to be in excess of the need of the undertaking, the Electricity Supply Committee has drawn up a revised tariff, to take effect as from the end of the September quarter. This includes the following reductions: Lighting (flat rate), from 7d. to 6½d. per kWh; heating and cooking, from 1½d. to 1¼d. per kWh; power (maximum demand system), secondary charge reduced from 1½d. to 1d. per kWh; long-term agreements (business), kW charge increment reduced from 50 to 25 per cent., and secondary charges of 1½d., 1¼d., and 1d. reduced to 1¼d., ¼d., and ¾d. per kWh. These decreases will bring all charges down to very near the pre-war level.

Battersea.—The Electricity Committee has recommended that the following reductions be made in the charges for electricity, as from the next reading of the meters:—Lighting, from 6d. to 5½d. per kWh; power (including heating and cooking), from 1½d. to 1¼d. per kWh.

Northern Ireland.—Londonderry.—*Electricity Agreement.*—A satisfactory agreement has been reached between the Corporation and the North of Ireland Shipbuilding Co. on the question of charges for electric power, and the company has served notice that it will require a supply early in January.

Portpatrick (Wigtonshire). — Proposed Electricity Scheme.—At a meeting of householders to consider a scheme for lighting the district by means of wind-driven plant, a representative of the Glasgow Electrical Engineering Co. explained the scheme. The estimated minimum charge for 10 lights would be £8 per consumer per annum. The representatives of the district are to communicate with the company.

Radcliffe.—Loan Sanctioned.—The Electricity Commission has sanctioned the borrowing of £4,435 for the provision of transformers, &c., at the Council's electricity works, in connection with a supply of electricity in bulk from the Lancashire Electric Power Co.

Rochester and Chatham.—Price Reductions.—The Kent Electric Power Co. is making the following reductions in the price of electricity from January 1st: For lighting, from 10d. to 9d. per kWh for the first 400 kWh per quarter and 7½d. beyond; for power from 3½ to 3d. per kWh.

South Africa.—Johannesburg.—The Tramways and Lighting Committee proposes to accept the offer of the Victoria Falls Power Co. for the supply of electrical energy for a period of five years.

Grahamstown.—The scheme for lighting the town by electricity has been put in hand, and it is anticipated that it will be completed by June, 1924. The estimated cost of carrying out the scheme is £33,000.

Torquay.—Loan.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £20,500 for laying mains from the power station at Newton Abbot to Torquay.

United States.—New York.—In a recent speech in New York, Dr. C. P. Steinmetz urged the full development of the State's water-power resources. He said that the present total power consumption in New York State was 5,000,000 h.p., and of this only a third was produced by water-power. He estimated that at least 4,000,000 h.p. remained undeveloped, and compared the State with California, where nine-tenths of the power used was hydro-electric.

Vale of Leven.—Electricity Supply.—The Dumbarton County Council is considering a request for supplying the district with electricity. The demand would be met by the Strathclyde Electricity Co.

Walsall.—Mains Extensions.—The Electricity Committee has recommended to the Town Council that the mains be extended at a cost of £9,250, in order to provide work for the unemployed.

Infirmary Lighting.—Mr. V. Delebecque has been asked by the Guardians to prepare a specification for the electric lighting of the infirmary.

Weardale.—Electricity Supply.—The Rural District Council has approved the proposal of the Electricity Committee for lighting the town by electricity.

Wigan.—Year's Working.—There was a net profit on the electricity undertaking for the past year of £6,196, as compared with £12,897 for the year 1920-21.

Weymouth.—Price Reductions.—The Town Council has reduced the charge for electricity for lighting from 9d. to 8d. per kWh; for power, from 3d. to 2½d. per kWh; for heating, from 3d. to 2½d. per kWh; and for public lighting, from 4.8d. to 4d. per kWh.

Wimbledon.—Rapid Expansion.—The chief electrical engineer (Mr. A. E. McKenzie) has drawn our attention to the rapidly-increasing use of electricity in the borough. During the period from March 31st to November 30th this year no fewer than 980 new consumers were connected, apart from a waiting list of 300. The present rate of connection is from 75 to 80 a week, which is claimed to be a record for an undertaking of this size—about 4,800 kW. The output during the period mentioned was 4,302,210 kWh—an increase of 1,272,663 when compared with the equivalent period of 1921. The growing popularity of electricity is attributed to the low charges.

Woking.—Price Reduction.—The Electric Supply Co. has reduced the charge for electricity for lighting from 10d. to 9d. per kWh, as from the end of the Christmas quarter.

Yeovil.—Special Order.—The Yeovil Electric Light and Power Co., Ltd., has applied to the Electricity Commissioners for authority to generate and distribute electricity for all purposes within the borough.

TRAMWAY AND RAILWAY NOTES.

Northern Ireland.—Belfast.—The City Council has decided to lay a new tramway line connecting Queen's Road tramway, *via* Hamilton Road and Dee Street Bridge, with Connswater, at an estimated cost of £49,000.

Blackpool.—Year's Working.—The annual report of the general manager of the Corporation tramways (Mr. Charles Furness) for the year ended March 31st last records an income of £261,980, comparing with £284,622 in the preceding year. Working expenses amounted to £204,882, as against £240,299, leaving a gross profit of £57,098 (£44,323). Capital charges increased from £44,179 to £50,965, and the net result was therefore a profit of £6,133, considerably more than that of the previous year—£144. Of this balance £4,000 was transferred to reserve and £1,236 carried forward. A total of £87,942 was spent on capital account during the year, and practically all of this was devoted to reconstruction of the permanent way. The number of passengers carried fell from 35,701,693 to 31,986,171 and the car-mileage from 2,580,830 to 2,254,520.

Continental.—Germany.—According to the *Svensk Trafiktidning*, a telephone arrangement has been fitted on the high- and low-level railway at Hamburg, whereby the name of the next station is announced in each of the coaches before the train's arrival. This is the first use of this arrangement in Europe, although similar arrangements have been in vogue on many American lines for some time.

Haslingden.—Fares.—The Corporation has received notice from the Ministry of Transport that the increased tramway fares sanctioned in 1920 are ineffective after February 15th. It has been decided to ask the Ministry to allow the present fares to continue in force and to approve of penny stages.

India.—Bombay.—Sanction for the electrification of the following sections of the G. I. P. Railway has been given:—Victoria terminus to Thana, Victoria terminus to Kurla and to Bandra *via* the Harbour branch of the Mahim Chord. The cost of the electrification of the whole suburban system of the G. I. P. Railway will amount to Rs.260 lacs.—*Reuter's Trade Service* (Bombay).

Calcutta.—A dispute has occurred regarding the dismissal of an employé of the tramway company, and the cars ceased running on December 21st.

Uruguay.—Montevideo.—The Uruguayan Chamber of Representatives has before it a project for the electrification of the Northern tramways. If the project becomes law, the Government would be authorised to issue mortgage bonds on the undertaking to the extent of 3,500,000 dollars, Uruguayan gold, to be spent on the electrification.—*Railway Gazette.*

TELEGRAPH AND TELEPHONE NOTES.

Afghanistan.—Long-Distance Telephony.—The Ameer of Afghanistan is negotiating with the Government of India for the installation of a long-distance telephone service between Peshawar and Kabul. The telegraph line from Kabul to Jallalabad has been completed, and connection between Jallalabad and Peshawar is expected to be effected by the middle of February.—*Reuter.*

China.—New Radio Stations.—The two radio stations, with accessories, contracted for by the Chinese Government with the Marconi (China) Co., Ltd., in October last are in course of erection at Hami (Sinkiang) and Lanchow (Kansu). The contractors are already in receipt of the material required, and have despatched four experts and engineers to Hami to supervise the installation, and another four engineers to Lanchow to conduct preliminary surveys.

Cuba.—Reduced Cable Rates.—The Western Union Telegraph Co. has extended its night and week-end cable letter services to all parts of Cuba. Plain language messages can now be sent to the island at reduced charges.—*Westminster Gazette.*

Germany.—Radio Telegraphy.—A radio express telegraph service has been opened between Berlin and Budapest. This is said to be the first occasion upon which Siemens telegraph instruments giving a speed of about one hundred words per minute have been employed in an international radio service.—*The Times.*

New Zealand.—Telegraph Rates.—Reductions totalling £300,000 yearly are announced in postal and telegraph charges. From February 1st to send 12 words by telegram will cost 9d. instead of 1s.—*Financial Times.*

South Africa.—Automatic Telephones.—In connection with the Post Office constructional grant last session of £400,000 and the Siemens' contracts for automatic switchboards at Maritzburg and Port Elizabeth, it is now proposed to extend the automatic telephone installations to rural and suburban districts, the small community experimental exchanges having been a marked success. It is probable that the Government's telephonic developments will be carried on for the next two or three years, and this must involve a large number of additional contracts.—*Reuter's Trade Service* (Capetown).

Storm Damage.—The gale on December 19th and 20th did much damage to telegraph and telephone lines; many wires in the Birmingham, Cambridge, Canterbury, Cardiff, Liverpool, Leeds, Maidstone, Manchester, Oxford, and Sheffield circuits were blown down, but no poles were reported down. Serious damage was also reported from the Continent, French and Italian circuits being considerably affected, while the Brussels and Dunkirk services were entirely dislocated.—*Evening News.*

Venezuela.—Telegraph Service.—A report by Mr. H. H. D. Beaumont, H.B.M. Minister, Caracas, dated September, 1922, on the economic and financial conditions of Venezuela discloses the fact that during 1921 the telegraph system was extended *via* Nutrias and Bruzual to El Amparo on the Colombian frontier and five new stations were opened: at San Lorenzo, Lagunillas, Santa Rita, Bruzual, and Palmarito. The total length of telegraph wire is 10,049 kilometres, with 218 stations. Radio stations now exist at Barquisimeto, 400 miles range; La Guaira, 400 miles range; Caracas, 300 miles range; Maracaibo, 300 miles range; Maracay, 300 miles range; Porlamar, 200 miles range; Puerto Cabello, 300 miles range; and San Cristobal, 400 miles range.

During the year a radio service with Trinidad (and thence by cable to Europe) was opened, the charge by the through rate to London being less than that charged by the French Cable Co. The latter, in anticipation perhaps of this competition, extended its service of deferred telegrams on November 1st, 1921, to the West Indies and Venezuela. A radio service between Venezuela and New York, *via* San Martin, has been established. Revenue from telegraphs has increased from Bs.468,257 in 1916-17 to Bs.1,010,364 in 1919-20, and Bs.1,131,754 in 1920-21. Expenditure in the last year was Bs.2,330,122, showing a deficit of nearly £50,000. Glass insulators of the type used in the U.S.A. are now being everywhere substituted for porcelain, as being free from certain inconveniences caused by the use of the latter, and much cheaper (less than one bolivar, compared with 60 cents each paid for porcelain insulators).

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—March 7th. Electricity Commissioners. Ash and dust extraction plant. (December 15th.)

January 24th. Victorian Railway Department. Insulated copper wire.*

January 31st. Three-phase a.c. motors, starting apparatus, and accessories for the Newport workshops (17 enclosed squirrel-cage motor sets, 2 h.p. to 20 h.p., two enclosed slip-ring motor sets, 25 h.p. to 30 h.p.).*

January 31st. Impedance bonds for power signalling; 100 three-position line relays; accumulators and accessories.*

January 8th. Postmaster-General's Department. Operators' calling devices. January 11th. Switchboard cable. January 17th. Telephone and telegraph apparatus. January 24th. Testing and telegraph instruments. February 22nd. Switchboard parts. March 1st. Telephone and telegraph parts. (December 22nd.)

Sydney.—January 29th. Municipal Council. Feeder protective apparatus for sub-stations.*

Newcastle (N.S.W.).—January 11th. Town Council. 750-kVA or, alternatively, one 1,000-kVA transformer voltage regulator.

Perth (W.A.).—March 1st. Government Tender Board. L.p. switchgear.*

Basford (Nottingham).—January 1st. Board of Guardians. Economiser. (December 15th.)

Belgium.—Belgian Military Buildings Department (Liège Rive-Droite Section) in Liége. Installation of electricity supply between the Military Sanatorium at Marchin-lez-Huy and the central electricity station.

January 10th. Office de l'Electricité, 25, Rue de la Charité, Brussels. 20 kilometres of heavily-insulated copper wire and 5 kilometres of copper cable.

January 13th. Municipal authorities of Saint-Gilles-lez-Bruxelles. The supply of armoured cable for d.c. transmission at less than 750 volts: 2,000 metres of 70 sq. mm. section, 1,000 metres of 16 sq. mm. section, and 7,000 metres of 19 sq. mm. section; also of 500 metres of lead-covered wire, 16 sq. mm. section, 15 kilos of bare copper 35 sq. mm. section, and 400 kilos ditto 10 sq. mm. section. Service de l'Electricité, 49, Rue de Bethléem, St. Gilles, Brussels.

Birmingham.—January 27th. Salvage and Stables Committee. Plant for the refuse destructor and salvage works. (December 15th.)

Bradford.—January 1st. Tramways Committee. Stores, including lamp fittings, insulating material, &c., for 12 months. Mr. R. H. Wilkinson, general manager of tramways, 7, Hall Ings, Bradford.

Cheadle and Gatley.—January 1st. Urban District Council. Sub-station switchgear and static transformer. (December 15th.)

Chile.—January 13th. State Railways. Covered copper wire, g.i. wire, g.i. cable, porcelain insulators, insulator pins, telegraph cords, &c.*

Egypt.—ALEXANDRIA.—January 17th. Ports and Lighthouses Administration. Stores, including electrical goods, for 12 months.*

Huntingdon.—January 3rd. Huntingdonshire County Council. New heavy-plate type battery, 400-420 amp. hours. (December 22nd.)

India.—MADRAS.—January 18th. Corporation. Eight 30-kVA, 3-phase transformers; h.p. switchgear; 15,000-V testing set; 700 30-ft. steel tubular poles; 10 tons h.d. copper wire, No. 8 gauge; 6 tons g.i. wire, No. 8 gauge; switchboard instruments. Specifications, &c., Revenue Officer, Corporation of Madras (Rs.1 per set.)

Manchester.—January 9th. Tramways Committee. Steel tramway poles. Mr. Henry Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Trafford Park Estates, Ltd. Reconstruction of the permanent way of the electric tramway in Trafford Park. Secretary, Estate Office, Trafford Park, Manchester.

South Africa.—CAPE TOWN.—January 12th. City Council. 10,300 yd. h.p. and l.p. cable; three 150-kVA single-phase transformers; four 100-kVA ditto; three 40-kVA ditto.*

Spain.—Electrification of Trans-Pyrenean Railway.—The Ministro de Fomento has been authorised to invite tenders for the electrification of the Ripoll-Puigcerda railway, which runs across the Pyrenees. Particulars from Señor Ingeniero Jefe de la Segunda Division de Ferrocarriles, Calle de Balmes 32 (2o), Barcelona.—*Reuter's Trade Service* (Madrid).

Post and Telegraph Authorities, Madrid. 1,000 metres of telephone cable with ten pairs of conductors, 6,000 metres with 25 pairs, 3,500 metres with 50 pairs, and 1,000 metres with 100 pairs of conductors required in connection with the State telephone system.

Stoke-on-Trent.—January 10th. Electricity Department. Neutral earthing resistance. Twelve months' supply of static transformers, and sub-station switchgear. (See this issue.)

Uruguay.—MONTEVIDEO.—January 16th. State Electricity Works. 45,000 metres v.i.r. cable.*

Wolverhampton.—January 17th. Electrical Engineer's Department. One 5,000-kW turbo-alternator, condenser and auxiliaries. (December 15th.)

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Edinburgh. — Tramways Committee. The Committee recommends that a contract for 2,500 tons of tram rails be given to the Compagnie Anglo-Belge d'Importation et Export, Brussels, whose tender amounts to £19,375, as compared with £24,375 quoted by an English firm; tie bars (£1,278), Hadfields, Ltd.; track rail fishplate bolts (£437), Chas. Richards and Son, Ltd.

Government Contracts.—The following Government contracts were placed during November, 1922:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Cables, boxes and accessories.—Foote Milne & Co.
Accumulator cells.—London Battery & Cable Co., Ltd.
80-kW automatically-controlled converting plant.—General Electric Co., Ltd.
Electrodes.—Quasi Arc Co., Ltd.
Switches.—Park Royal Engineering Works, Ltd.
Sub-contractors for electrical work for motor boats.—G. E. Taylor and Sons.

AIR MINISTRY.

Condensers.—British Insulated & Helsby Cables, Ltd.
Electric sensitive drills.—F. Pollard & Co., Ltd.
Electrical conduit and conduit fittings (term contract).—General Electric Co., Ltd.; Stella Conduit Co., Ltd.
Motor switchgear, &c.—General Electric Co., Ltd.
Modified T.F. Receivers.—Muirhead & Co.
Thermo ammeters.—Weston Electrical Instrument Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Electric cable.—Callender's Cable & Construction Co., Ltd.
Telegraph material.—Siemens Bros. & Co., Ltd.
Wireless telegraph installation, &c.—Marconi's Wireless Telegraph Co., Ltd.

POST OFFICE.

Testing, protective apparatus, &c.—Evershed & Vignoles, Ltd.
Leclanché battery boxes.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Connolly's (Blackley), Ltd.; Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
E.S. conduit and fittings.—J. McDougall, Ltd.
E.L. fittings.—S. Heath & Sons, Ltd.
Insulators.—Buller's, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Earth plates.—Buller's, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Lead sleeves.—G. Farmiloe & Sons, Ltd.
H.d. copper wire.—R. Johnson, Clapham & Morris, Ltd.
Manufacture, supply and drawing-in and jointing cables.—Pontypool-Abergavenny: W. T. Henley's Telegraph Works Co., Ltd. Preston-Lancaster: W. T. Henley's Telegraph Works Co., Ltd. Leeds-Catterick: Western Electric Co., Ltd. Catterick-Newcastle-on-Tyne: Johnson and Phillips, Ltd. Newcastle-on-Tyne-Jedbergh: Callender's Cable and Construction Co., Ltd. Jedbergh-Edinburgh: Siemens Bros. & Co., Ltd.
Lift (Monument Telephone Exchange).—W. Wadsworth Sons, Ltd.
Telephone exchange equipment.—Dale & Co. (Oxford Circus); Ormerod and Sons (Rochdale); Pocock Bros. (S.E.); United Kingdom Provisional Institution (Strand); and Basil Street Hotel (Knightsbridge, S.W.), Relay Automatic Telephone Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Electric wiring Cricklewood Chart Factory.—Edmundson's Electricity Corporation, Ltd.
Electric wiring Windsor Castle.—T. Clarke & Co., Ltd.

Navan (Co. Meath).—Urban Council. Accepted:—
Installation of electrical house feeders.—Irish Electrical Construction Co., Dublin.

Southend-on-Sea.—Town Council. Accepted:—
Re-conditioning and installing three 900-kW Diesel engines at £3,700 each.—Belliss & Morcom.
Three d.c. dynamos for coupling to three 900-kW engines (£5,094).—Crompton & Co., Ltd.
Twelve 19-ft. lengths of copper busbar (£130).—Sydney, Son & Co.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Juvenile Christmas Lectures. At 21, Albemarle Street, W. At 3 p.m. On "Six Steps up the Ladder to the Stars," by Prof. H. H. Turner, F.R.S. Saturday, December 30th, "The Discovery of the Planet Neptune" (Lecture II); Tuesday, January 2nd, "Photographing the Stars" (Lecture III); Thursday, January 4th, "The Spectroscope and its Revelations" (Lecture IV); "Saturday, January 6th, "Two Great Streams of Stars" (Lecture V).

Institute of Transport.—Monday, January 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "Air Transport," by Mr. F. Handley-Page.

Roentgen Society.—Tuesday, January 2nd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary meeting.

Institution of Railway Signal Engineers.—Wednesday, January 3rd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3 p.m. Paper on "Rotary Interlocking Block," by Mr. A. Wallis.

Chelmsford Engineering Society.—Thursday, January 4th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Financial Considerations of Engineering," by Mr. J. R. Watson.

Physical Society of London and The Optical Society.—Wednesday and Thursday, January 3rd and 4th. At the Imperial College of Science, South Kensington, S.W. From 3 to 6 p.m. and 7 to 10 p.m. Annual exhibition. January 3rd, at 4 p.m., and January 4th, at 8 p.m. Lecture on "Reproduction of Colour by Photographic Processes," by Mr. W. Gamble. January 3rd, at 8 p.m., and January 4th, at 4 p.m. Lecture on "Recent Photo-Elastic Researches on Engineering Problems," by Prof. E. C. Coker, F.R.S.

Institution of Electrical Engineers.—Thursday, January 4th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Lecture on "Variable-speed a.c. Motors without Commutators," by Mr. F. Creedy.

Electrical Power Engineers' Association (Southern Division).—Friday, January 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Water and its Action on Steam Boilers," by Mr. J. H. Paul.

Junior Institution of Engineers.—Friday, January 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Wave Power Transmission," by Mr. W. Dinwoodie.

"Model Engineer" Exhibition.—Opens Friday, January 5th. At the Royal Horticultural Hall, Westminster, S.W.

British Electrical Development Association.—Friday, January 5th. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "Possibilities of the Immediate Future and Competition with Other Forms of Light and Heat," by Mr. J. W. Beauchamp.

The I.E.C. and Former Enemy Nations.—We learn from a letter written by the president of the French Electrotechnical Committee to the editor of *La Revue Générale de l'Electricité* that the five Germans who were present at the recent meetings at Geneva (reported in our last issue) were not on the same footing as the delegates from other nations; they were simply the guests of the Swiss committee.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for:—

Orsova reflectors for electric street lamps.
Edison electric pen (a reader desires to secure one).

NOTES.

Scientific Novelties.—The London University and other bodies have arranged an exhibition of scientific novelties, with the very laudable object of assisting the hospitals of London. The exhibition is to be held at King's College, Strand, and will run from December 28th to January 10th. On each day there will be given popular lectures by authorities on various subjects, and the list includes a number by electrical engineers and scientists. The exhibits are to be classed under six heads: Engineering, "wireless," physics, chemistry, biology, and geology. The charge for admission for adults will be 2s. 6d. in the afternoon and 2s. in the evening. Children will be admitted for a shilling.

Fatalities.—Two deaths from electrical causes have been reported from the Midlands recently. In the first case a young girl received a fatal shock from 350-V overhead supply wires at Accrington which had been brought down by the weight of snow upon them.

The other case was the death of a boy at Bacup who became entangled with some telephone wires which had been broken during a storm and had come into contact with wires carrying a current at a pressure of 230 V.

Anti-Dazzle Light Bill.—An Anti-Dazzle Light Bill, the *Daily Mail* is informed, will be introduced into Parliament during the next session by the Ministry of Transport. Its chief provisions will be: No lamp may be used with a forward illumination exceeding 150 ft. unless it complies with the anti-dazzle regulations. Lamps exceeding a forward range of 150 ft. must throw the main beam below the vision of pedestrians and drivers of other vehicles. There will also be a provision that cyclists must carry rear lamps. France is also considering means of stopping the dazzle-light nuisance, and unless some common policy is adopted it may mean that motorists wishing to visit France will have to buy new lamps. As to the need for dazzle-light regulations most motorists are agreed.

Appointments Vacant.—Instructor in electrical installation and wiring for the Kingston-on-Thames Technical Institute. See "Official Notices" to-day.

The Leicester Electricity Undertaking.—With reference to our description of this undertaking, it is stated on p. 978 of this issue that each boiler is fitted with a steel-tube economiser—an inaccuracy, as the Green economisers are fitted with cast-iron tubes.

Lectures.—At a meeting of the Edinburgh Electric Society, on December 8th, Mr. T. Orr lectured on "Power Transmission." The subject was treated from the mechanical aspect, and the author dealt with qualities and advantages of the varied classes of belts and gears now available. The different kinds of bearings and their purposes were described. Mr. Orr demonstrated models specially constructed for the lecture. On December 22nd, Mr. G. Mackintosh read a paper on "Common Telephone Faults," in which he described the most practical methods of tracing and repairing the failures of the everyday types of home and office telephones.

Glasgow and District Radio Club.—The club is having a highly successful season, the membership being now well over 200. A number of interesting lectures have been held. On December 14th Mr. A. F. Gray, a vice-president, demonstrated a two-valve set which he has constructed, using reactance into tuned anode, which is said to be almost necessary to comply with the Postmaster-General's regulations.

As "fading" in connection with transmission from the broadcast stations has been causing club members a considerable amount of trouble, six members arranged to listen-in specially to the full programme of the Manchester station on a particular night. The reports are being tabulated by Mr. Pick, one of the members of the committee, who is to open a discussion on the subject, and it is hoped to find some suitable grounds for further experiments later.

Long-distance Radio-Telegraphy. — "Wireless Service between Australia and Great Britain" was the subject, on December 19th, of a lecture by Mr. E. T. Fisk, managing director of the Amalgamated Wireless of Australia, Ltd., at a meeting of the Royal Colonial Institute. Sir John Cockburn presided, and, according to *The Times*, the lecturer said that direct communication between England and Australia was now practicable for twenty-four hours daily. The Australian Amalgamated Co., he said, had become a national undertaking, which enjoyed the freedom of policy and efficiency of organisation which inherently distinguished a public company from a Government department. The company undertook to carry all classes of messages between Great Britain and Australia at a charge not exceeding two-thirds of the existing cable rates. The Australian high-power station would be erected near Sydney or Melbourne, and operated direct from the heart of the city. At the capital cities of the other States feeder stations would deal with all traffic between these States and the main trunk station. A third service would provide communication between Australia and the surrounding Pacific Islands; a fourth would communicate with ships at sea, and a fifth would link up isolated inland settlements. When these services were fully established extensions of the main trans-ocean service would be undertaken to link up Australia directly with all the countries of importance in Europe, Asia, Africa, and America. When other Dominions, such as India and South Africa, had established suitable high-power stations the company would be ready immediately to conduct inter-Dominion services. With regard to New Zealand, it was not yet decided whether she would communicate direct with Great Britain, or would establish a feeder station in connection with the Australian main service.

INSTITUTION NOTES.

The Institution of Electrical Engineers.—Informal Meetings Section.—At the meeting of the Informal Section, on December 18th, Mr. J. R. Bedford was in the chair, when Mr. E. E. Sharp opened a discussion on "Time Switches." He said the periods of the clocks were practically standardised now at 1, 14, and 45 days' run. For the one-day run a cheap type of clock might be used, because small time-keeping errors could be adjusted daily, but a rigid framework and a dust-proof case were essential. For the longer runs the switch had to be put "on" automatically, as well as "off" and the double operation commonly had to be done twice or more daily. The clock must, therefore, be a powerful one, and with good makes a maximum error of 2½ minutes a week was guaranteed. Mr. Sharp exhibited some excellent lantern slides showing various clock and switch parts. He explained the safeguards for wear, escapement, compensation and temperature variation, &c., and also for sound electrical contacts; the oil break was easily incorporated in the clock operation, and he had supplied for years time switches up to 400 amperes, 600 volts, single pole, and 300 amperes, three pole. Mr. Sharp held the opinion that electrically-wound clocks were not commercially practicable, nor did he favour the ingenious "Solar" device for time setting by cams shaped to the earth's orbit, and correspondingly controlling the lighting. It required different cams for every 50 miles of latitude. He claimed a life of 20 years or more for time switches under normal conditions, and instanced an installation of 1,700 by which, after all allowance for repayment of loan, interest and maintenance, a saving of £4,000 in four years was effected. He told of having to devise applications to new conditions at the rate of 300 a year.

Fourteen members took part in the discussion.

North-Eastern Centre.—The January meetings of the Centre will be held at Armstrong College, Newcastle-on-Tyne, as follows: January 8th, at 7.30 p.m., visit and address by the president (Mr. Frank Gill, O.B.E.). January 22nd, at 7.15 p.m., lecture by Mr. F. Creedy on "Multispeed and Cascade Induction Motors."

Irish Centre.—Mr. Frank Gill, O.B.E., President, lecturing on telephony before the Irish Centre, Dublin, referred to the great development of the telephone in America and Denmark. The trade of Ireland was greater than that of Denmark, but in the latter country there were 262,000 telephones in use, while in the Irish Free State the number was only about 20,000, although the populations of the two countries were practically identical. In Denmark there were 8½ telephones for every 100 of the population, and in Ireland 1.63 telephones for every 100 people. During the past 22 years telephones had increased by 890 per cent. in Denmark, and in Ireland by 360 per cent., and the figures in Denmark were practically identical with those of America. He did not see why Ireland should be behind Denmark in making the telephone an auxiliary in the promotion of industry. Traffic followed the lines as they ran, and the Government of the State should see to it that help was given for adequate development.

Junior Institution of Engineers.—A paper on "Oil Film Lubrication and its Application to the Michell Thrust Block" was delivered by Mr. J. Ward, B.Sc., on December 8th. The history of the Michell thrust block was outlined and examples of its application were mentioned. The British Admiralty had adopted the Michell thrust block exclusively in its battleships. In H.M.S. *Hood* the shaft h.p. was 36,000 and the thrust taken by a single collar was 100 tons. The main object of the paper was the application of the oil film to lubrication under extreme loads, and the author took as a base the investigations of Prof. Osborne Reynolds and the development of the Michell Mathematical Extension. Several models kindly lent by Messrs. Michell Bearings, Ltd., were exhibited, showing different designs of Michell bearing.

Midland Section.—Dr. O. O. Garrard delivered his presidential address on "The Economics of Engineering" on December 12th. He pleaded that engineering societies and institutions should, in their corporate capacity, discuss the economic questions lying at the foundation of their work—the problem of unemployment, and the avoidance of industrial strife. Professional engineers might do a great deal of good by evolving some form of arbitration in the engineering industry which would be acceptable both to the employers' associations and the trade unions.

Association of Engineers-in-Charge.—The following are the arrangements for the new year:—

January 10th.—"The Selection of Fans and Their Application," by Mr. A. Fleming Browne.
January 20th.—Social and dance.
February 10th.—Social and dance.
February 14th.—"Hydraulic and Electric Lifts," by Mr. C. H. J. Day.
March 14th.—"Scientific Instruments in the Boiler House," by J. B. C. Kershaw.
April 11th.—"Military Bridge Building Under Fire," by Col. C. E. P. Sankey, R.E. (ret.).
April 14th.—Social and dance.
The annual dinner will take place in March.

Society of Engineers.—Among the awards made by the Society for papers read or published during 1922 are: President's Gold Medal to Dr. C. V. Drysdale, O.B.E., for his papers on "The Testing of Small Electrical Plant"; Society Premium (value three guineas) to Mr. A. S. E. Ackerman, B.Sc. (Eng.), for his paper on "The Physical Properties of Clay" (fourth paper); Clarke Premium (value five guineas) to Mr. R. C. Hill, of the Gloucestershire Engineering Society (associated with the Society of Engineers), for his paper on "The Submersible Pump"; and Geen Premium (value five guineas) to Mr. A. G. Short, of the Birmingham Association of Mechanical Engineers (associated with the Society) for his paper on "Heating."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review posted as to their movements.

It is announced that Sir John Dewrance, K.B.E., has resigned from the Advisory Committee to the Department of Overseas Trade.

St. Marylebone Electric Supply Committee has re-elected Ald. J. A. G. Beaumont chairman, and Ald. Duncan Watson vice-chairman, for the ensuing year.

The Council has also confirmed the appointments of these gentlemen as its representatives upon the Conference of Local Authorities Owning Electricity Undertakings in Greater London, and the Wages Conference of Local Authorities (Greater London), for the year ending March 31st, 1923.

Mr. V. Delebecque has commenced practice as a consulting electrical, mechanical, and radio engineer, at Ash Villa, Sandwell Street, Walsall, and he desires to receive catalogues.

Preston Corporation Tramways Committee has recommended the appointment of Mr. Henry Clayton as general manager and engineer of the Corporation Tramways undertaking, in succession to Mr. J. F. Simpson, who takes up his new appointment as borough electrical engineer in the new year. The two positions were previously merged.

Obituary.—Mr. W. H. Madden.—The death has occurred of Mr. W. H. Madden, chairman of the Kilmallock (Co. Limerick) Electric Light & Power Co.

NEW COMPANIES REGISTERED.

Inventions Developments, Ltd. (186,517).—Private company. Registered December 19th. Capital, £1,030 in 1,000 preference shares of £1 each and 600 ordinary shares of 1s. each. To adopt agreements with A. L. Davis, S. G. Wybrow, and A. Slatter for the acquisition of the patents referred to therein, and to carry on a business not particularly described. The provisional directors are: S. G. Wybrow, A.M.I.E.E., Royal Aircraft Establishment, South Farnborough, Hants., electrical engineer; A. Slatter, M.I.E.E., Sardinia House, Kingsway, W.C.2, electrical engineer. Registered office: Sardinia House, Kingsway, W.C.2.

Yeovil Electric Light and Power Co., Ltd. (186,456).—Private company. Registered December 15th. Capital, £10,000 in £1 shares. The objects are as indicated by the title. The first directors are: A. N. Rye, 6, Eaton House, Belsize Park Gardens, N.W.; F. E. Gripper, Shirley Lodge, Malbrook Road, Putney, S.W.; W. E. Brandreth, 37, London Road, High Wycombe, Bucks; C. H. Jones, "Coniston," Shortlands Grove, Shortlands, Kent. Qualification: £50. Remuneration as fixed by the company. Secretary: C. H. Jones. Registered office: Broad Sanctuary Chambers, 11, Tothill Street, Westminster, S.W.

White & Mantle, Ltd. (186,403).—Private company. Registered December 14th. Capital, £1,000 in £1 shares. To adopt an agreement with A. L. White for the acquisition of the business of an electrical engineer and contractor carried on by him at 23a, Old Bond Street, W. The first directors are: A. L. White, 23a, Old Bond Street, W.1, electrical engineer; A. Proserpi, 27, Wray Crescent, Tollington Park, N.4, caterer; W. F. Mantle, 45, Canterbury Grove, West Norwood, S.E.27, electrical engineer.

The British Broadcasting Co., Ltd. (186,424).—Registered as a "public" company on December 15th, with a nominal capital of £100,000 in 100,000 cumulative ordinary shares of £1 each. The said shares confer on the holders thereof the right to receive out of the profits of the company a fixed cumulative dividend at 7½ per cent. per annum on the amounts paid up or credited as paid up thereon, but not to any further or other participation in profits. The rights of the cumulative ordinary shares in the original capital may not be altered, or in any manner affected, except in accordance with clause 61 of the original articles of association. The said clause provides that, subject to the previous approval of H.M. Postmaster-General for the time being, the holders of the said shares may at any time and from time to time, whether before or during liquidation, by an extraordinary resolution passed at a meeting of such holders, consent on behalf of all the holders of shares of the class to the issue or creation of any shares ranking equally therewith or having any priority thereto, or to the abandonment of any preference or priority or of any accrued dividend or the reduction for any time or permanently of the dividends payable thereon, or to the amalgamation into one class of the shares of any two or more classes, or to the division of shares of one or more class or classes into shares of different classes, or to any alteration in the memorandum of association, varying or taking away any rights or privileges attached to the said cumulative ordinary shares, or to any scheme for the reduction of the company's capital affecting such shares in a manner not authorised by the articles, or to any scheme for the distribution (though not in accordance with legal rights) of assets in money or in kind in or before liquidation, or to any contract for sale of the whole or part of the company's property or business, determining the way (though not in accordance with legal rights) in which the purchase consideration shall be distributed, and generally consent to any alteration, contract, abrogation of rights and privileges, compromise or arrangement which the persons voting thereon could, if *sui juris* and holding all the shares of the class, consent to or enter into, and such resolution shall be binding on all the holders of the shares of the class.

Article 61 is not to be read as implying the necessity for such consent in any case in which, but for such article, the object of the resolution could have been effected without it under the general provisions of the articles. The written consent of the holders of three-fourths of the class shall have the same effect as an extraordinary resolution passed at a meeting of the holders of the shares and of the class.

The objects of the company are: To acquire from H.M. Postmaster-General a licence, in such form and subject to such terms and conditions as he may from time to time prescribe, for the erection, establishment, and operation within the United Kingdom of Great Britain and within Ireland, of stations as a public utility service for the "broadcasting" supply to the public, by means of wireless telephony and/or wireless telegraphy of news, information, concerts, lectures, educational matter, speeches, weather reports, theatrical entertainments and any other matter which for the time being may be permitted by or within the scope or ambit of the said licence; to equip and install the said stations with all requisite or convenient plant and machinery, and to carry on (only so far as may be necessary or convenient for the furtherance of the objects of the company) the business of ironfounders, mechanical and electrical engineers, brass founders, metal workers, tool makers, wood workers, builders, &c.

The shares may be allotted or disposed of as the Board may determine, provided that the Board shall not, without the previous written approval of H.M. Postmaster-General for the time being, allot more than 60,006 shares in the initial capital to the following six companies or their nominees, *viz.*:—

Marconi's Wireless Telegraph Co., Ltd.
Metropolitan-Vickers Electrical Co., Ltd.
Radio Communication Co., Ltd.
British Thomson-Houston Co., Ltd.
General Electric Co., Ltd.
Western Electric Co., Ltd.

and that the Board shall, up to a total of 39,994 shares, issue to applicants, being *bona fide* British manufacturers of wireless apparatus other than the above six companies, the full amount of shares (not exceeding 10,000 to any one such applicant) for which such applicants may apply.

The minimum cash subscription on which the directors may proceed to allotment is £7.

The Board may, without assigning any reason, decline to register any transfer of shares.

The directors are to number not less than seven nor more than nine. Six of the directors are to be nominated by the six companies above named. Such nominated directors (called "representative" directors) may appoint an additional director, to be known as the "permanent chairman director." In the event of the representative directors failing to appoint the permanent chairman director within three weeks after the incorporation of the company, and so often as a vacancy occurring in the office of permanent chairman director shall not be filled up by the representative directors within three weeks of the occurring thereof, H.M. Postmaster-General for the time being may, on the request of two representative directors, appoint the permanent chairman director. The first directors are:—Godfrey Chas. Isaacs, Marconi House, W.C.2, director of "Marconi" companies; John Gray, Crown House, Aldwych, W.C.2, director of Shielton, Ltd., Corbel, Ltd., and the Hotpoint Electric Appliance Co., Ltd.; Henry M. Pease, Norfolk House, W.C., managing director of Western Electric Co., Ltd.; Sir William Noble, Magnet House, Kingsway, W.C., director of General Electric Co., Ltd., and Walker-Western Co., Ltd. Major Basil Binyon, 34-5, Norfolk Street, W.C.2, managing director of Radio Communication Co., Ltd., and director of Mullard Radio Valve Co., Ltd., C. F. Elwell, Ltd., Radio Press, Ltd., and London Radio College, Ltd.; Archibald McKinsley, 4, Central Buildings, The Broadway, S.W., Metropolitan-Vickers Electrical Export Co., Ltd., Cosmos Lamp Works, Ltd., and Vickers Australia, Ltd.; Lord Gainford, Headlam Hall, Gainford, Durham.

The remuneration of directors is to be £300 each per annum (£500 for the chairman), free of income tax. The registered office is at 15, Savoy Street, W.C.2.

Bowyer-Lowe Co., Ltd. (186,475).—Private company. Registered December 18th. Capital, £800 in £1 shares. To carry on the business of electricians, mechanical and general engineers, woodworkers, manufacturers of and dealers in apparatus, machinery and appliances, convenient for the application of electricity, &c. The first directors are: A. E. Bowyer-Lowe, Veloce, South View, Letchworth; H. W. Widgery, Canonleigh, Broadway, Letchworth (both permanent subject to holding one-fifth each of the issued share capital) with £100 each per annum as directors' fees, together with a salary of £500 per annum so long as they devote their whole time and attention to the company's affairs. They shall be joint chairmen and preside at alternate meetings while owners in equal shares of not less than half the issued share capital. Secretary: H. W. Widgery. Solicitors: H. M. Heckford, 19, Leys Avenue, Letchworth, Herts.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Mitchell's Electrical and Wireless, Ltd.—Satisfaction in full on December 1st, of debentures dated January 16th, 1922, securing £550.

Battiscombe & Harris, Ltd.—Particulars filed of £10,000 debentures authorised November 14th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Reed's Patent Engine Co., Ltd.—First mortgage debenture dated December 12th, 1922, to secure £500, charged on freehold and leasehold property, and the company's undertaking and other property, present and future, including uncalled capital (if any). Holder: F. J. Reed, Hythe, Southampton.

Frederick Braby & Co., Ltd. (2,537c).—Return dated August 31st (filed November 7th), 1922. Capital, £660,000 in 42,500 ordinary, 17,500 preference, and 6,000 employés' shares of £10 each. 39,500 ordinary, 14,500 preference, and 3,988 employés' shares taken up. £566,880 paid. £13,000 considered as paid. Mortgages and charges, £33,475.

British Arc Welding Co., Ltd. (108,759).—Return dated August 23rd, 1922. Capital, £50,000 in £10 shares. 1,474 shares taken up. £12,740 paid. £2,600 considered as paid. Mortgages and charges, nil.

City of Oxford Motor Services (formerly City of Oxford Electric Tramways, Ltd.).—Satisfaction to the extent of £1,000 on December 7th, 1922, of charge dated February 20th, 1914, securing £46,000.

Porlock and District Electric Supply Co., Ltd.—Mortgage dated December 1st, 1922, to secure £400 charged on "The Stores," Porlock, Somerset. Holder: C. Blackford, Porlock.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £6,200 on December 7th, 1922, of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1915, securing £250,000.

Stuart Turner, Ltd.—Mortgage on "Broad Gate" public-house, Henley-on-Thames, dated November 16th, 1922, to secure all moneys due or to become due from the company to L.C.W. and Parr's Bank.

Pacific and European Telegraph Co., Ltd. (36,683).—Return dated November 14th, 1922. Capital, £100,000 in £10 shares. All shares taken up. £4 per share called up. £40,000 paid. Mortgages and charges, £66,500.

CITY NOTES.

Fuller's United Electric Works, Ltd.

The third ordinary general meeting was held on December 21st at Winchester House, E.C., Mr. George Fuller presiding. In proposing the adoption of the report the chairman said the shareholders had so recently had the affairs of the company carefully explained at the various meetings which had been held that it was unnecessary for him to go into any details on that occasion. It was expected that the sanction of the High Court would be given next January to the scheme of reorganisation which had been arranged, when the new financial arrangements would come into operation. He would like to take that opportunity of personally thanking the shareholders for the way in which they had met the difficult problems that had come before them. He felt sure that their confidence would be ultimately justified. During the past few months the directors had thoroughly overhauled the organisation of the business, with results which had been very encouraging. Great economies had been effected; changes had been made in the personnel; and the general efficiency of the business had been greatly improved. Although trade conditions in the country were still far from good he was pleased to say that the encouraging conditions of their own business, which commenced in the autumn, had been maintained. With the economies they had effected and the improved financial conditions under which they expected to carry on they had every hope that the business would resume its old successful and profitable condition.

Mr. F. J. Gordon seconded the motion, and the report was adopted.

British Columbia Telephone Co., Ltd.

The *Financier* reports meetings of debenture holders and shareholders of this company, which were held in London on December 8th to consider resolutions approving an amalgamation with another company of the same name. Sir J. Leigh Wood, K.B.E., explained that the company was incorporated under the laws of the Province of British Columbia, and it was proposed to amalgamate with a company incorporated under the laws of the Dominion of Canada. The resolutions would regularise the system which had been in operation during the last three or four years.

Mr. G. H. Halse, the president of the company, said that when telephones were first started in British Columbia every little town had its own system, and there were no long-distance lines. About 1900 the present company had been formed with a provincial charter to unite those systems into one company. From a small beginning the company had grown to be an important undertaking, able to supply the whole of British Columbia with a telephone service, and doing a large business with the United States.

Anglo-Argentine Tramways Co., Ltd.—Sir George A. Touche, Bart. (chairman) presided at a special meeting of holders of the second preference shares on December 19th, which was called to give effect to the scheme outlined in our issue of December 15th. The chairman explained in some detail the circumstances which had necessitated this method of dealing with arrears of dividend, and the requisite resolution was adopted unanimously. The proposals were again approved at a subsequent extraordinary general meeting, at which, also, the alteration of the basis of the directors' remuneration was agreed to.

Constantinople Telephone Co.—An announcement appeared in *The Times* of December 22nd, signed "J. E. Kingsbury, Representative in the United Kingdom," stating that the coupons on the 6 per cent. obligations and the 6 per cent. certificates, due January 1st, 1923, are payable on or after that date at the Imperial Ottoman Bank, 26, Throgmorton Street, London, E.C.2.

Claud Hamilton, Ltd.—According to the *Financial Times*, a dividend of 5 per cent. for the year is recommended, carrying forward £18,363, after writing off depreciation, but subject to E.P.D. and corporation tax.

Pinchin, Johnson & Co., Ltd.—The usual dividend at the rate of 6¼ per cent. per annum, less tax, on the preference shares for six months to December 31st is announced.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., less income tax, upon the issued capital.

Marconi's Wireless Telegraph Co., Ltd.—Interim dividend of 5 per cent., less tax, upon the ordinary shares.

Eastern Telegraph Co., Ltd.—Interim dividend of 10 per cent. per annum, free of tax, on the ordinary stock.

Cork Electric Tramways and Lighting Co., Ltd.—Dividend of 7½ per cent., less tax, on the preference shares for the eighteen months ended December, 1921.

W. & T. Avery, Ltd.—Interim dividend of 5 per cent., less tax, on the ordinary shares.

C. A. Vandervell & Co., Ltd.—The directors report a loss of £205,734 for the year ended March, 1922. The directors hope at an early date to place before the shareholders proposals for the situation that his arisen as the result of this and the loss of the previous year.

Crompton & Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended September, 1922.

STOCKS AND SHARES.

Wednesday Evening.

With only three full working days in the present week, the Stock Exchange did not expect to find anything like active business conditions prevailing, and the anticipation is fully justified. A main feature of the markets continues to be the strength of shares of the home electricity supply companies. The public are taking a more lively interest in the market owing to the confidence felt in regard to increased dividends to be declared in respect of the current six months. The table showing the yield per cent. on the principal shares, as worked out in our list, is the object of careful examination.

In the market it is claimed that Brompton ordinary are still amongst the cheapest shares of their class, though the yield in their case is barely 6 per cent. on the money. City Lights pay nearly 6½ per cent. allowing for the accrued dividend, County of London ordinary barely 5½ per cent., Westminsters 6½ per cent., and St. James's a little less. These returns on the money are worked out upon the basis of the middle prices given in the Stock Exchange Official List, but would-be buyers know to their disappointment that shares cannot often be obtained at the figures given, though the few sellers who come in are pleasantly disappointed at getting either the middle prices, or very near them. This simply shows the strength of the market and the difficulty which exists of buying shares in this department. After the way in which the industry has suffered during the war years, the change during 1922 has come as a pronounced relief, and, although the prophet will walk warily in venturing to estimate what are likely to be the chances in the future, the prosperity of the electricity supply industry during the present twelve months has been striking enough to warrant the assumption that market values are not likely to show much decline.

Kensington ordinary have risen to 8, and London Electrics are 1/16 higher at 2 15/16. It is now anticipated that the London Electric Co. will be amongst those announcing a higher dividend, and there would be a good deal of satisfaction at this company taking its place amongst the concerns that pay their shareholders a better rate than 4 per cent. Possibly a certain misconception has arisen in regard to the London Electric Co., but the fact remains that the Brighton Railway contract has hitherto done little to raise the London to a high rank amongst the other undertakers, and the fact of the dividend having been on a very modest scale has given rise to mild doubt as to how far these big contracts yield more than a comparatively modest profit.

Edmundsons have issued a good report, and the shares are harder, the ordinary changing hands up to 2½. The Urban figures are awaited with interest, and the improvement in the status of such companies begins to attract more general attention. Electric Supply Corporations have changed hands up to 18s. 3d. General Electrics rose 1s. to 18s. British Aluminium lost three pence at 16s. middle. British Insulated rose to 12s., to revert to 11s. 3d. Siemens look a firmer market, though the price is nominally unchanged at 2s. 10½d. The company's 10 per cent. preference are on offer at 30s. 9d., with

1s. dividend included in the price. This makes the yield to a buyer, to-day, £6 13s. 6d. per cent. on the money. The 4½ per cent. debenture stock has risen to 90 on a demand from holders who had stock drawn at 100 in the middle of this month.

India Rubber 5 per cent. bonds, with interest due in March and September, can be bought at 94½, giving £5 6s. on the money, without taking into account redemption at 100 in March, 1926. Callender's 7½ per cent. "B" preference at 25s., c.d., January and July dividends, give 6 per cent. London Electric Wire and Smiths 7½ per cent. preference at 23s. 6d. afford a six guineas yield.

Marconis again hardened to 2¼, and Canadians have advanced to 10s. 9d. The Anglo-American stocks hold their rises. The only change in the Eastern division is ¼ decline in Globe Telegraph ordinary.

Some of the holders of Anglo-Argentine Tramways first preference are exchanging into the second preference, and the movements in the prices reflect this "straddle." Mexicans are steady, the only quotable change is a gain of 2 points in Mexico Tramways seconds, to 58½. British Columbia Railway issues have not altered. Amongst the new stocks, Marconi debenture is higher at 3¼ premium, and the new County of London ordinary, now 12s. 6d. per cent., have gone up to 6s. 6d. premium.

The rubber market exhibits no particular vitality. Iron, coal and steel shares, after their sharp rises, are disposed to react on profit-taking by earlier buyers who preferred to sell rather than to pay for their stock at the end of the year. Babcock & Wilcox, for this reason, eased off to 3 7/16. Armstrongs and Vickers maintain most of their recently-acquired strength.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend. 1920.	1921.	Price Dec. 23, 1922.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	10½	—	£5 17 1
Charing Cross Ordinary	8	9	7½	—	5 16 2
do. do. do. 4½ Pref.	4½	4½	4⅞	—	5 7 5
Chelsea	6	6	6¾	—	4 9 0
City of London	14	14	2⅛	—	6 7 10
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	+ 6d.	5 8 6
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	8	+ ½	6 5 0
London Electric	2½	4	2½	+ ⅛	4 8 6
do. do. 6 per cent. Pref.	6	6	5⅜	—	5 17 1
Metropolitan	7	7	6¾	—	5 7 8
do. 4½ per cent. Pref.	4½	4½	4¾	—	5 9 1
St. James' and Pall Mall	12	12	9½	—	6 6 4
South London	7	7	4⅜	—	5 18 0
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	7⅛	—	6 7 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	102½	—	5 17 1
do. Def.	1½	34/6	23¼	—	6 5 0
Chile Telephone	6	6	6¼	—	4 16 0
Cuba Sub. Ord.	7	7	8	—	8 15 0
Eastern Extension	10	10	19½	—	5 4 0
Eastern Tel. Ord.	10	10	190½	—	5 5 0
Globe Tel. and T. Ord.	10	10	19¼	— ¼	5 5 0
do. do. Pref.	6	6	11⅛	—	5 7 10
Great Northern Tel.	24	22	282½	—	7 13 0
Indo-European	10	10	35½	—	7 1 0
Marconi	25	15	2¼	+ ⅛	6 15 6
Oriental Telephone Ord.	12	12	2⅞	—	*5 4 0
United R. Plate Tel.	8	8	7⅞	—	*5 6 8
West India and Panama	Nil	Nil	10/-	—	Nil
Western Telegraph	10	10	19	—	*5 5 8

Home Rails.

Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	59½	—	3 15 8
do. District	Nil	1	45	— ¼	2 4 9
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	87½	—	*4 11 5

Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5½	12½	81¾	— ⅛	7 3 0
do. do. 2nd Pref.	Nil	6½	43⅛	+ ⅛	5 17 9
do. do. 5 per cent. Deb.	5	5	80½	—	6 2 8
Brazil Tractions	Nil	Nil	48	—	8 6 8
British Columbia Elec. Rly. Pcs.	5	5	73½	—	6 7 5
do. do. Preferred	5	93/-	76½	—	*6 8 6
do. do. Deferred	8	124/-	87½	—	*7 0 6
do. do. Deb.	4½	4½	78½	—	5 8 3
Mexico Tram. 5 per cent. Bonds	Nil	Nil	81½	—	6 2 8
do. 6 per cent. Bonds	Nil	Nil	58½	+2	Nil
Mexican Light Common	Nil	Nil	21½	—	Nil
do. Pref.	Nil	Nil	61½	—	Nil
do. 1st Bonds.	Nil	5	67	—	7 8 2

Manufacturing Companies.

Babcock & Wilcox	15	16	3 7/16	— 1/16	4 12 6
British Aluminium Ord.	10	5	16/-	—3d.	6 8 6
British Insulated Ord.	15	15	2½	—	6 13 4
Callenders	15	15	2⅛	—	6 17 0
do. 6½ Pref.	6½	6½	1⅜	—	5 15 7
Crompton Ord.	10	5	15/-	—	6 13 4
Edison-Swan	10	Nil	2/6	—	Nil.
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	1⅜	—	7 5 6
English Electric	8	5	15/9	—	6 7 0
do. do. Pref.	6	6	18/3	—	6 10 6
Gen. Elec. Pref.	6½	6½	21/9	—	5 19 6
do. Ord.	10	5	18/-	+1/-	5 11 6
Henley	15	15	2⅛	—	6 11 8
do. 4½ Pref.	4½	4½	4½	—	5 2 10
India-Rubber	10	—	11/8	—	—
Met.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	1⅛	—	—
Telegraph Con.	20	20	25½	—	*4 11 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, December 27th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	6¾d.	...
a Ammoniac, Sal per ton	£62	...
a Ammonia, Muriate (large crystal) ,,	£48	...
a Bisulphide of Carbon ,,	...	...
a Borax ,,	£30	...
a Copper Sulphate ,,	£26 15s.	...
a Potash, Chlorate per lb.	5d. to 5½d.	...
a ,, Perchlorate ,,	7¾d.	...
a Shellac per cwt.	£17 15s.	...
a Sulphur, Sublimed Flowers ,,	£9	...
a ,, Lump ,,	£9 2s. 6d.	...
a Soda, Chlorate per lb.	8½d.	...
a ,, Crystals per ton	£6	...
a Sodium Bichromate, casks per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots per ton	£100	...
b ,, Wire per lb.	1/9 to 2/6	...
b ,, Sheet ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£165	...
Grade II ,, ,,	£122	...
Grade III ,, ,,	£68	...
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ,,	11¾d. to 1/-	...
c ,, Wire, basis ,,	9½d.	...
c Copper Tubes (solid drawn) ,,	1/1½	...
c ,, Bars (best selected) per ton	£96	...
c ,, Sheet ,,	£96	...
c ,, Rod ,,	£96	...
d ,, (Electrolytic) Bars ,,	£71 15s.	45s. inc.
d ,, ,, Sheets ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£81 15s.	45s. inc.
d ,, ,, H.C. Wire per lb.	10¼d.	¼d. inc.
f Ebonite Rod ,,	5/6	...
f ,, Sheet ,,	8/-	...
g German Silver Wire ,,	2/6	...
h Gutta-percha, fine ,,	12/6	...
h India-rubber, Para fine ,,	1/1½	...
f Iron Pig (Cleveland Warrants) per ton	92s. 6d.	...
f ,, Wire, galv. No. 8, P.O. qual. ,,	£24	...
g Lead, English Pig ,,	£27 10s.	5s. inc.
g Mercury ,,	£12 to £12 2s. 6d.	...
e Mica (in original cases) small per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/1	...
p ,, drawn bars and rods ,,	1/8	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ,,	1/3½	¼d. inc.
o Platinum per oz.	£25	£2 inc.
d Silicium Bronze Wire per lb.	1/0½	...
r Steel, Magnet, in bars ,,	10d.	...
n Tin, Block (English) per ton	£181 10s. to £182	£6 inc.
n ,, Wire, Nos. 1 to 16 per lb.	8/2	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Physical and Optical Societies' Exhibition.—This exhibition, which is to be held on Wednesday and Thursday, January 3rd and 4th, 1923, at the Imperial College of Science, South Kensington, will be open in the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.). Mr. W. Gamble will give a lecture on "Reproduction of Colour by Photographic Processes" at 4 p.m. on January 3rd and at 8 p.m. on January 4th. Prof. E. C. Coker, F.R.S., will give a lecture on "Recent Photo-Elastic Researches on Engineering Problems" at 8 p.m. on January 3rd and at 4 p.m. on January 4th. All the lectures will be illustrated with experiments. Over 50 firms are exhibiting scientific apparatus, and a number of experimental demonstrations have been arranged. Invitations to attend have been given to members of the Institutions of Electrical Engineers, Mechanical Engineers, the Chemical Society, the Faraday Society, the Wireless Society of London, and the Röntgen Society. Admission in all cases will be by ticket only, and therefore members of the Societies mentioned desiring to attend the exhibition should apply to the secretary of the Society to which they belong. Others interested should apply direct to Mr. F. E. Smith, O.B.E., F.R.S., hon. secretary of the Physical Society, Admiralty Research Laboratory, Teddington, Middlesex.

Tramway Fares in Marks.—The Cologne tramway administration, a local newspaper says, has made a Christmas present to the inhabitants by a further increase in fares. Single tickets are now 100 marks each and transfer tickets 120 marks, while foreigners are required to pay 250 marks for a ticket.

ESTIMATING OFFICE ORGANISATION.—IV.

By MAJOR J. C. CONNAN, B.Sc., A.M.I.E.E.

Overhead Charges.—It is extremely important that a reasonably accurate knowledge of the overhead charges of a business should be known, as they are generally allowed for by the use of a multiplier to the actual net self cost, and consequently any error in their calculation will be greatly enlarged in the final estimates. The multiplier used will generally be based on an analysis of the overhead charges incurred during a period of six months or, at the very outside, of 12 months, and is therefore already somewhat out of date when actually used. However, this is not of serious importance if the figure has been carefully calculated in the first instance, as it can easily be modified should the charges have changed during the intervening period.

It can be readily understood that, for no two firms, even when of the same size, will these charges be equal, as they depend to such a great extent on the ability of the manager to run the business economically, as well as the completeness with which each firm is provided with equipment.

The overhead expenses of a firm are sometimes described as all those expenses which are incurred in getting business. However, this is hardly wide enough, and they may be more accurately defined as those expenses which cannot be definitely charged up to any one job. They comprise:—1. Interest on capital employed in the business. It will be necessary to pay interest on the capital employed if this has been borrowed, and even if the contractor has himself provided the capital he should still allow for the payment of the interest which the money could earn if employed elsewhere. To be strictly correct, the figure used for the rate of interest should be that current in the money market on the date of the analysis, but usually it is sufficient to allow 5 per cent. 2. Salaries. This covers the salaries of all the office staff (bookkeepers, estimating and erecting engineers, clerks, typists, &c.), salesmen, a salary for the owner if he gives his time to the business, and a proportion of the foremen's wages. It is to the interests of the firm to keep a certain number of foremen continuously on its books, and, in fact, to treat them as staff. This enables experienced, trustworthy men to be chosen who quickly get to know the methods of work of the engineers, and consequently give a consistency to all the work done by the firm. The whole of their wages need not be put to overhead charges, but only that portion of them which cannot be charged up to any job. The same might be done in the case of the erecting engineer's salary, but as the amount of time which he spends on any one job is comparatively short, and as a good deal of his time must be spent in the office, the distinction is hardly worth the expense necessary to get the items out, and consequently it is more satisfactory to charge up the whole of his salary to this account. 3. Travelling expenses and other out-of-pocket expenses incurred by the owner, salesmen, engineers, &c., whilst on the firm's business. 4. Rent, rates, and taxes. This should include offices, stores, and workshops where used. 5. Heating, lighting, and water for offices, stores, and workshops, except when already included under 4. 6. Repairs to buildings, except when included under 4. 7. Stationery. This includes office books, letter paper, data sheets, estimate forms, typewriting materials, pencils, ink, &c., blue prints and drawings when obtained outside, printing of letter paper, &c. 8. Postage, telephone, and telegrams. Separate items should be kept for these, as they are a fruitful source of waste. 9. Advertisements. This includes advertisements in trade journals, local papers, &c., as well as all expenses attached to printing and sending out of leaflets, catalogues, &c. 10. Office cleaning. The expenses incurred for a charwoman, window cleaning, touching up office furniture, &c. 11. Insurance. All insurance premiums should be booked here, including those for health (to cover National Health Insurance), fire, burglary, accidents to workmen (to cover workmen's compensation), strikes, glass breakage, and personal insurance for owner to cover accidents. 12. Technical and trade papers. A certain number of suitable trade journals will be taken in by every office, and the subscriptions for these should be booked here. 13. Staff expenses. Christmas presents or other bonuses paid to the staff and not already included under salaries. 14. Training apprentices. Any expenses involved in training an apprentice should be included here. 15. Bad debts. The amount involved will entirely depend on the care with which orders are accepted, and will be very different for various firms. With care it should not exceed 1 per cent. of the turnover. 16. Legal expenses. These may be necessitated by the recovery of bad debts, accidents to workmen, disputes arising out of the interpretation of contracts, &c. Under this heading should also be included all charges for information concerning the standing of firms, &c., obtained from information bureaux, detective agencies, &c. 17. Association fees. This includes fees paid to contractors' associations or other technical bodies of which the owner or any of the staff may become members for business reasons. 18. Maintenance charges. This item is to cover charges under contracts having a guarantee or maintenance clause. If it is necessary to estimate this item, allow, for a moderate-sized business, five hours per week for one man. 19. Repair charges. This should include:—(*a*) Repairs to tools, ladders, handcarts, &c.; (*b*) repairs to office furniture; (*c*) repairs to bicycle or car if kept for business purposes. 20. Depreciation. Write off each year:—(*a*) 33⅓ per cent. cost of tools; (*b*) 25 per cent. cost of bicycle or car; (*c*) 20 per cent. cost of office furniture; (*d*) percentage for depreciation of stock. The amount will depend on the class of stock kept, the quantity, and the rapidity with which it is turned over. This item should also allow for breakages of material and for providing samples for tests, &c., unless these can be charged to the customer.

The sum of the amounts obtained for the above items will give the total overhead charges for the period used in their calculation. There are three methods in which these overhead charges may be expressed:—1. As a percentage of the turnover during the above period: (*a*) constant percentage, and (*b*) variable percentage. 2. As a percentage on the wages actually expended on the contracts executed during the period. 3. Similar to 2, but together with a percentage on the cost of material used on the contracts. To apply this percentage to the estimate, it is only necessary to add the percentage found to the corresponding quantity in the estimate, which would be for:—1. (*a* or *b*) Total self cost. 2. Estimated labour cost. 3. Estimated labour and material costs separately. (*Net costs being used.*)

The first method is the one most commonly employed, and is quite straightforward in its application. Some firms consider that the expenses involved in obtaining the smaller jobs are relatively more heavy than those of getting the large work, and that consequently in applying the figure to an estimate a variable percentage should be made, the figure taken depending on the size of the job. It will be found, however, that this method will involve the loss of practically all the smaller work unless all contractors in the district use the same percentages, a circumstance which is extremely unlikely to happen without agreement amongst the contractors. It is not a method, therefore, which is likely to be much used.

As the amount of repair work relatively to new work may vary considerably in any one business during the course of a year, it is sometimes considered more correct to employ method 2. Whether this method is able to give more consistent results than the first is extremely doubtful, but if applied throughout the office for all work will give quite as good results, and is no more laborious to apply.

Method 3 is an amplification of method 2, and as the percentages of items 1-20 to be applied to labour and material respectively are arbitrarily chosen, it possesses no advantage over the former method, and need not, therefore, be further considered.

From the above it would appear that method 1 (*a*) is the one most easily applied and one which gives results as accurate as any of the others.

HINTS ON RADIO MERCHANDISING.*

BY W. F. CROSBY.

During the past eight or ten months the radio industry in America has gone forward by unparalleled leaps and bounds, and there are many lessons that may be derived by other countries where the radio craze has just started. In the first place, America has always had a certain number of firms devoted almost exclusively to the manufacture of radio apparatus for amateur use. These firms were pretty well scattered and competition was not keen, but the grade of apparatus turned out was very carefully designed, as a rule, and built in accordance with good engineering practice.

However, with the advent of radio broadcasting, business men and manufacturers were quick to grasp the money-making possibilities of radio, and many factories, which had been used for other lines of manufacturing, were turned over, almost exclusively, to the making of radio apparatus of all descriptions. Most of the winter season the market was absolutely barren of good radio apparatus, with the result that all sorts and conditions of parts and sets were turned loose in great haste. Needless to say, practically all this material was of inferior design or simply a cheap copy of some already successful make. This sort of manufacturing did a great deal of harm to radio, the average small dealer not knowing enough about the business to distinguish between good and bad apparatus.

The result of this was that people who had recently become interested and did not know the good from the bad, bought almost anything that they could lay their hands on. The new manufacturers were swamped with orders, and every day saw new firms being started for the manufacture of radio apparatus. The beginner, who had just purchased the parts for his set, or the set complete, soon found out that the set that he had was not of the best quality, and consequently he very quickly became disgusted with what he had and usually either dropped out of the field entirely or disposed of what he had waited until a later date, when he knew he would be able to buy the right sort of apparatus.

Many of these new firms entered the business without any technical knowledge whatsoever, and many of them did not even take the trouble to hire a more or less experienced amateur to lend them a guiding hand. They went at the business absolutely blindly, and took a chance on what they were about to make. Other firms employed the services of some young man who thought that he might possibly, some day, become a radio engineer at the expense of the firm hiring him. From actual observation, it has been found that these young men usually stayed with a firm long enough to get one good set working. They might waste three or four months in useless experimenting where an experienced engineer would have known exactly what to do at the very start. This cost the employers quite a sum of money for apparatus as well as the time spent, and usually the set when put on a commercial basis was not much good for the reception of radio broadcasting. This did not happen in every case, but it did occur so often that the dealers became suspicious of every salesman who came into their stores.

The better class of radio manufacturers went at this in an entirely different manner. Here the procedure was to hire a staff of good men under an experienced radio engineer. In this way a research department was kept constantly on the job, with the result that this type of manufactured set was usually far in advance of the others. New types of apparatus were designed in this way, and from these very laboratories we have secured some of our finest radio apparatus.

Business men, who sense the possibilities in the merchandising of radio apparatus, will find it advisable to give some study to the subject, although this does not mean that any preparation is necessary in the fundamentals of wireless telegraphy or electricity. It is essential for the dealer to be able to explain the principles of wireless and also the uses and operation of the instruments that he has for sale, and to be able to order intelligently the special requirements of his customers, who will want more and more parts and accessories as their interest in radio increases.

Many merchants, who do not have the time to devote to this study, delegate it to some member of their organisation who is specially adapted to the work, and these individuals are placed in charge of the radio department. Such a manager who is equipped for the work can do much to develop interest in the business by the formation of clubs, lectures, &c.

The radio store should be arranged attractively as well as conveniently, and its location should be carefully thought out. Nearly all of the buyers first wish to hear the set that they are about to buy in operation, and the wise dealer has a section of the store wired up in such a way that any piece of apparatus may be easily and quickly tested out. In this way the purchaser will have confidence in what he is buying, and will return again and again for other apparatus that may be needed. Some of the stores have arranged small booths along one wall having on exhibition at all times radio sets that they are handling. These are arranged in such a way that by the throwing of a switch it is possible for the customer to listen and compare any of the sets on exhibition. This has proved a great advantage to some of the stores, and it seems to be very popular with the public. One of the largest of these stores has a man specially engaged, who knows radio, and he delivers a short talk every half hour to whoever happens to be on hand. It frequently happens that his audience mounts up to thirty or forty people during one of these talks, and many sales are made in this way. This speaker starts in at one end of a long shelf on which all of the sets are placed, and delivers a few minutes' talk on each one, telling exactly what it is used for and demonstrating its tuning qualities as well as the loudness of the signals. In all, there are about eight sets in this unique exhibition, and it is said that this firm does the largest retail business of any in the Metropolitan section. The store was thronged from the start with eager buyers, and in time as the news spread it was noticed that many who had been there before came back and brought their friends with them.

A feature of the radio business which, so far, has not been gone into very deeply by any of the manufacturers or dealers, is the sale of receiving sets to the farmers who are located far from the usual centres. Through the New England section, as well as some of the Western States, certain firms have sent out salesmen equipped with light automobiles and having a set installed and working on the machine. The aerial, in a case of this type, was usually made so that salesmen could toss a weighted cord over the limb of some nearby tree, using this, in turn, to hoist one end of the aerial some feet above the ground. The other end ran directly to a connection on the car, and then the car was backed off until a span of possibly one hundred feet of wire was in use. This made a highly successful aerial when connected to the proper receiving set, and the ground connection was usually made to a convenient hydrant or, if no hydrant was handy, the salesman drove a piece of iron pipe into the ground and had his ground wire connected to this. Such an outfit as this would arrive at some small country town on a Saturday morning and the set be rigged up, as described above, at some prominent corner or wherever the village authorities would permit. The crowds of farmers from surrounding territories coming into the town for the evening would be attracted by this radio outfit, and if the salesman knew his job he would usually be able to take many orders. His duties would be, not only to tickle the crowd with a demonstration of the music in the air, but also to tell them how the time signals, weather reports, and stock prices were given out every day and night. The farmer was quick to grasp the advantages of knowing the latest prices of his products, and usually his family had a great deal to say about the attractiveness and educational features of the rest of the programme. It seems that this scheme could be carried out in almost any section of the world, provided the broadcasting stations were installed and operated.

Sooner or later the radio enthusiasts are going to be educated to the point where they will be able to distinguish very easily the difference between good and bad apparatus, and the dealer who knows what to avoid in the first place, and stocks up on good apparatus only, will be the man who stays in business and secures the profits. A few hints about the design of apparatus will not be out of place here.

* From *Export* (U.S.A.).

In the first place it has been found that any coil of wire used in a receiving set that is made with shellac, varnish, or paint, to hold wires in place, is usually far inferior to the same piece of apparatus made up without any of these adhesives. The reason for this is that the shellac or varnish makes an imperfect insulation or dielectric, with the result that the distributed capacity is too high, consequently lessening the efficiency of the piece of apparatus. Another point that may be well worth investigating is the type of insulation used in the set or the parts thereof. A great many pieces of radio apparatus are made up on a base form of some insulating compound, the difference being in the fact that there are all sorts of compounds, some of which are insulating and some are not. Others are of such composition that a small blow will cause them to chip and crack or completely fall apart. In variable condensers it sometimes happens that there are end pieces made of some sort of insulating compound, arranged in such a way that they form bearings for the movable shaft. Unless the compound is of tough mixture, or suitable bearings of metal are inserted, the shaft will soon wear down the compound, getting the condenser out of alignment and making it useless.

The bane of the American radio man, as well as of a great many dealers, has been the poorly made crystal set. Manufacturers got the idea that a set of this type could be built in great quantities and sold by the thousand, thereby reducing cost both at the plant and to the consumer. These sets, owing to the extreme cheapness of price, cannot be tested out as they should be, and the fact that they are made for cheapness shows that certain essential parts have been eliminated in order to reach the desired end. Experience has shown that these cheap crystal sets are incapable of close tuning, and it frequently happens that the owner of such a set, while listening to a broadcasting programme, will find that he is unable to hear any more of the music owing to the fact that some ship or commercial station is transmitting in code and the set is unable to tune out the unwanted station. It must be remembered that in order to get results, a set must be equipped with several controls, otherwise such an outfit will be interfered with by every station in its radius.

One of the greatest mistakes, and one well worth avoiding, is the advertisement of a guarantee of the distance at which a set will receive messages. The experienced radio man when he sees an advertisement of this type at once brands the advertiser as either a fake or one who does not know his business. If the advertiser will only stop to think the thing over, he will realise how ridiculous it is to state on paper how far his set will work. Weather conditions, the location of the receiving station, the height and length of the aerial, the skill of the operator, and the power of the transmitting station are all vital factors that cannot be ignored. In actual operation a set will not act the same in any two localities, and for that matter it will not act exactly the same any two nights running. The atmosphere is constantly changing, with the result that the distance from which messages may be received is also changing. In summer the range of the set will be greatly reduced owing to the fact that there is a great deal more atmospheric electricity in the air than there is in the winter, and this variation taking place every day, to a certain extent, is just enough frequently to spoil all calculations as to what a set will do. Any radio man will vouch for this statement, that though he has the best receiving set possible, there is no telling how far the set will receive. It is like asking: "How far can a dog howl?" with just about as much sense connected with it. If a manufacturer is willing to tell you how far his set will receive, you may rest assured that he is new at the game, and probably doesn't know what he is talking about.

One of the most important parts of any receiving set is the receivers, or head sets, as they are sometimes called, and it must be remembered that here again the small dealer is liable to run into trouble. The average receiver that is manufactured to-day is not suitably designed for the extremely loud signals coming from a good set with amplifiers. Head 'phones are made primarily to receive faint sounds, and when overloaded, and forced to give out several hundred times the sound that they are designed for, it frequently happens that they either burn out or the diaphragms are bent. This diaphragm is the only moveable part of the receiver, and it is held in place rigidly over a magnetic field but only a few thousandths of an inch away. The incoming signal varies the current flowing through the magnetic field, consequently strengthening or weakening the magnet as the case may be. As the magnet gets stronger the diaphragm is drawn toward it, and it is this deflection of the diaphragm that actually turns out the sound waves that we hear. If the signal is too loud, the extreme movement of the diaphragm will cause it to hit the magnet, thereby making the rattle or tinny sound so often heard in the receiver, and also in a loud speaker using a receiver of this type. There are a few makes of receivers suitable for this sort of work, but the regular power loud talker is what should be used wherever loud signals are wanted.

There are many more little things such as this that may mean success or failure to the concern about to enter the radio field, but they cannot all be taken up at this time. The dealer is cautioned to use good practical sense in selecting what apparatus he intends stocking. Watch out for constructional details, and above all beware of the freak pieces of apparatus that are being placed on the market nearly every day. The great growth of radio in America may serve to give many lessons to other countries where the broadcasting business is about to be started or has not gained such a foothold as it has here.

ELECTRICAL EXPORTS OF THE UNITED STATES.

Below are given the values (and quantities where available) of electrical machinery and appliances exported from the United States of America during 1921, showing the principal countries of destination. For purposes of comparison the figures for 1920 are added, and notes of increases or decreases are made.

	1920	1921	Inc. or Dec.
Batteries.—	Dol.	Dol.	Dol.
Total ...	6,634,000	3,832,000	– 2,802,000
To Norway	79,000	21,000	– 58,000
,, Great Britain ...	469,000	285,000	– 184,000
,, Canada	1,834,000	1,103,000	– 731,000
,, Cuba	406,000	160,000	– 246,000
,, Argentina	448,000	294,000	– 154,000
,, Chile	64,000	98,000	+ 34,000
,, China	147,000	66,000	– 81,000
,, Australia	365,000	185,000	– 180,000
,, New Zealand ...	227,000	172,000	– 55,000
,, British South Africa	251,000	97,000	– 154,000
,, British India ...	230,000	84,000	– 146,000
,, Brazil	190,000	66,000	– 124,000
,, Mexico	302,000	325,000	+ 23,000
,, Spain	206,000	76,000	– 130,000
,, France	114,000	26,000	– 88,000
Carbons.—			
Total ...	1,478,000	434,000	– 1,044,000
To Italy	63,000	—	– 63,000
,, Norway	16,000	—	– 16,000
,, Great Britain ...	74,000	58,000	– 16,000
,, Canada	938,000	234,000	– 704,000
,, Mexico	52,000	20,000	– 32,000
,, Japan	132,000	53,000	– 79,000
Dynamos or generators.—			
Total ...	7,796,000	7,942,000	+ 146,000
To France	615,000	215,000	– 400,000
,, Belgium	73,000	104,000	+ 31,000
,, Spain	282,000	337,000	+ 55,000
,, Italy	245,000	134,000	– 111,000
,, Norway	161,000	17,000	– 144,000
,, Great Britain ...	152,000	119,000	– 33,000
,, Canada	700,000	672,000	– 28,000
,, Mexico	209,000	480,000	+ 271,000
,, Cuba	637,000	776,000	+ 139,000
,, Argentina	71,000	163,000	+ 92,000
,, Brazil	193,000	413,000	+ 220,000
,, Chile	315,000	154,000	– 161,000
,, Uruguay	70,000	4,000	– 66,000
,, Colombia	86,000	44,000	– 42,000
,, Peru	40,000	96,000	+ 56,000
,, China	714,000	553,000	– 161,000
,, Hong Kong	104,000	12,000	– 92,000
,, India	798,000	377,000	– 421,000
,, Japan	1,403,000	1,755,000	+ 352,000
,, Australia	167,000	327,000	+ 160,000
,, British South Africa	70,000	303,000	+ 233,000
Fans.—			
Total No. ...	72,200	63,700	– 8,500
$ ...	1,365,000	1,270,000	– 95,000
To Canada, No.	11,000	10,000	– 1,000
$... ...	116,000	122,000	+ 6,000
,, Argentina, No. ...	6,000	4,500	– 1,500
$... ...	138,000	90,000	– 48,000
,, China, No.	4,000	4,150	+ 150
($... ...	83,000	110,000	+ 27,000
,, British India, No. ...	16,000	16,000	—
$ ...	344,000	433,000	+ 89,000
,, Cuba, No.	10,000	7,000	– 3,000
$	192,000	150,000	– 42,000
,, Mexico, No.	3,000	3,500	+ 500
$	68,000	77,000	+ 9,000
Heating and cooking apparatus.—			
Total ...	1,801,000	1,637,000	– 164,000
To Norway	198,000	16,000	– 182,000
,, Great Britain ...	152,000	172,000	+ 20,000
,, Canada	346,000	255,000	– 91,000
,, Japan	79,000	91,000	+ 12,000
,, Argentina	108,000	180,000	+ 72,000
,, Australia	139,000	110,000	– 29,000
,, Mexico	112,000	195,000	+ 83,000
,, Brazil	132,000	103,000	– 29,000

	1920 Dol.	1921 Dol.	Inc. or Dec. Dol.
Insulated wire and cables.—			
Total ...	8,209,000	8,574,000	+ 365,000
To Belgium	73,000	41,000	− 32,000
,, Denmark	58,000	23,000	− 35,000
,, France	102,000	134,000	+ 32,000
,, Netherlands ...	298,000	155,000	− 143,000
,, Norway	592,000	28,000	− 564,000
,, Portugal	38,000	10,000	− 28,000
,, Spain	78,000	75,000	− 3,000
,, Sweden	125,000	2,343,000	+ 2,218,000
,, Great Britain ...	450,000	274,000	− 176,000
,, Canada	271,000	197,000	− 74,000
,, Mexico	586,000	655,000	+ 69,000
,, Cuba	944,000	741,000	− 203,000
,, Argentina	465,000	278,000	− 187,000
,, Brazil	1,267,000	670,000	− 597,000
,, Chile	136,000	243,000	+ 107,000
,, Colombia	98,000	106,000	+ 8,000
,, Peru	165,000	112,000	− 53,000
,, Uruguay	55,000	69,000	+ 14,000
,, China	562,000	440,000	− 122,000
,, Japan	49,000	110,000	+ 61,000
,, British India ...	186,000	286,000	+ 100,000
,, Australia	55,000	156,000	+ 101,000
,, New Zealand ...	80,000	163,000	+ 83,000
,, Dutch East Indies ...	112,000	122,000	+ 10,000
,, Philippine Islands	431,000	175,000	− 256,000
,, British South Africa	34,000	83,000	+ 49,000
Interior wiring supplies and fixtures.—			
Total ...	3,386,000	1,849,000	− 1,537,000
To Norway	43,000	3,000	− 40,000
,, Canada	957,000	348,000	− 609,000
,, Mexico	209,000	232,000	+ 23,000
,, Cuba	379,000	205,000	− 174,000
,, Argentina	163,000	116,000	− 47,000
,, Brazil	252,000	110,000	− 142,000
,, Australia	101,000	121,000	+ 20,000
Metal filament lamps.—			
Total No. ...	16,143,000	10,920,000	− 5,223,000
$ ...	4,052,000	3,149,000	− 903,000
To Italy, No.	330,000	12,000	− 318,000
$	81,000	5,000	− 76,000
,, Canada, No. ...	3,907,000	747,000	− 3,160,000
$	974,000	171,000	− 803,000
,, Peru, No.	240,000	378,000	+ 138,000
$	65,000	106,000	+ 41,000
,, Mexico, No.	1,146,000	1,442,000	+ 296,000
$	317,000	457,000	+ 140,000
,, Cuba, No.	2,074,000	954,000	− 1,120,000
$	606,000	290,000	− 316,000
,, Argentina, No. ...	683,000	1,380,000	+ 697,000
$ ...	153,000	392,000	+ 239,000
,, Brazil, No.	2,249,000	1,137,000	− 1,112,000
$	465,000	302,000	− 163,000
,, Australia, No. ...	479,000	1,111,000	+ 632,000
$ ...	117,000	266,000	+ 149,000
,, British South Africa, No.	245,000	218,000	− 27,000
$	69,000	70,000	+ 1,000
Lamps, arc	25,000	13,000	− 12,000
,, *carbon filament*	115,000	125,000	+ 10,000
Magnetos, spark plugs, &c.—			
Total ...	3,601,000	1,314,000	− 2,287,000
To Italy	144,000	2,000	− 142,000
,, Great Britain ...	365,000	70,000	− 295,000
,, Canada	1,030,000	367,000	− 663,000
,, Argentina	186,000	146,000	− 40,000
,, India	210,000	40,000	− 170,000
,, Japan	126,000	50,000	− 76,000
,, Australia	161,000	77,000	− 84,000
,, New Zealand ...	119,000	21,000	− 98,000
,, British South Africa	108,000	23,000	− 85,000
,, Mexico	79,000	60,000	− 19,000
Motors.—			
Total ...	13,422,000	15,444,000	+ 2,022,000
To France	701,000	525,000	− 176,000
,, Great Britain ...	1,240,000	601,000	− 639,000
,, Canada	2,404,000	1,443,000	− 961,000
,, Mexico	398,000	872,000	+ 474,000
,, Cuba	972,000	946,000	− 26,000
,, Brazil	449,000	583,000	+ 134,000
,, China	557,000	736,000	+ 179,000
,, India	477,000	988,000	+ 511,000
,, Japan	1,486,000	1,655,000	+ 169,000
,, Belgium	704,000	444,000	− 260,000
,, Italy	406,000	84,000	− 322,000
,, Spain	426,000	391,000	− 35,000
,, Argentina	318,000	903,000	+ 685,000
,, Australia	660,000	2,374,000	+ 1,714,000
,, New Zealand ...	257,000	329,000	+ 72,000
,, Philippine Islands	156,000	232,000	+ 76,000
,, British South Africa	217,000	660,000	+ 443,000

	1920 Dol.	1921 Dol.	Inc. or Dec. Dol.
Meters and measuring instruments.—			
Total ...	2,677,000	2,726,000	+ 49,000
To Canada	489,000	310,000	− 179,000
,, Argentina	66,000	74,000	+ 8,000
,, Brazil	132,000	104,000	− 28,000
,, China	148,000	128,000	+ 20,000
,, Japan	441,000	537,000	+ 96,000
,, Italy	102,000	16,000	− 86,000
,, New Zealand ...	48,000	81,000	+ 33,000
,, Australia	111,000	306,000	+ 195,000
,, Mexico	96,000	194,000	+ 98,000
Rheostats and controllers.—			
Total ...	708,000	1,044,000	+ 336,000
Switches and accessories.—			
Total ...	4,439,000	4,033,000	− 406,000
Telegraph apparatus.—			
Total ...	714,000	1,011,000	+ 297,000
To Great Britain ...	66,000	68,000	+ 2,000
,, Sweden	—	441,000	+ 441,000
,, Canada	84,000	71,000	− 13,000
,, Japan	73,000	60,000	− 13,000
Telephones.—			
Total ...	3,899,000	4,799,000	+ 900,000
To France	27,000	95,000	+ 68,000
,, Italy	132,000	16,000	− 116,000
,, Netherlands ...	10,000	160,000	+ 150,000
,, Spain	129,000	46,000	− 83,000
,, Norway	20,000	79,000	+ 59,000
,, Spain	129,000	46,000	− 83,000
,, Belgium	133,000	179,000	+ 46,000
,, Sweden	1,000	249,000	+ 248,000
,, Switzerland ...	98,000	113,000	+ 15,000
,, Great Britain ...	276,000	358,000	+ 82,000
,, Canada	810,000	640,000	− 170,000
,, Brazil	408,000	301,000	− 107,000
,, Mexico	52,000	127,000	+ 75,000
,, Argentina	111,000	131,000	+ 20,000
,, Colombia	62,000	115,000	+ 53,000
,, British India ...	73,000	120,000	+ 47,000
,, China	234,000	121,000	− 113,000
,, Japan	76,000	233,000	+ 157,000
,, Dutch East Indies...	143,000	210,000	+ 67,000
,, Australia	188,000	620,000	+ 432,000
,, New Zealand ...	77,000	150,000	+ 73,000
Transformers.—			
Total ...	4,803,000	7,988,000	+ 3,185,000
To France	125,000	643,000	+ 518,000
,, Italy	30,000	347,000	+ 317,000
,, Netherlands ...	18,000	2,000	− 16,000
,, Spain	331,000	450,000	+ 119,000
,, Norway	283,000	152,000	− 131,000
,, Peru	67,000	150,000	+ 83,000
,, Mexico	214,000	497,000	+ 283,000
,, Brazil	565,000	628,000	+ 63,000
,, Chile	60,000	321,000	+ 261,000
,, China	330,000	712,000	+ 382,000
,, Japan	455,000	1,082,000	+ 627,000
,, Canada	167,000	265,000	+ 98,000
,, Australia	254,000	1,017,000	+ 763,000
,, India	748,000	251,000	− 497,000
,, New Zealand ...	66,000	264,000	+ 198,000
,, British South Africa	58,000	203,000	+ 145,000
All other electrical machinery and appliances (except locomotives).	32,868,000	28,632,000	− 4,326,000
Grand total of electrical machinery and appliances (except locomotives).	102,000,000	95,818,000	− 6,182,000
Locomotives, electric—			
Total ...	880,000	2,121,000	+ 1,241,000

Lecture.—On December 12th Dr. W. Clow, M.A., B.Sc., gave a lecture on "The Medical Aspects of Electricity" before the Paisley Association of Electrical Engineers. The speaker commenced by observing that there was probably no activity of animal mechanism which was not accompanied by a demonstrable difference of potential. He then spoke of the possibilities of X-rays both for examination and curative treatment, and from this proceeded to high-frequency currents and ionisation, and illustrated his remarks by means of lantern slides.

The "Hydro" Lamp.—The Hydro-Electric Power Commission of Ontario announces that it has developed a lamp in a number of sizes, with a tested life of 1,500 hours, which is 50 per cent. longer than that of the usual types. This is being supplied in large and small quantities to the Commission's consumers.

FAILURES OF RESIDENT ENGINEERS AND CONTRACTORS.

A Joint meeting of the National Association of Supervising Electricians and of the Association of Engineers-in-Charge, to discuss the problem of "Where the Electrical Contractor and the Resident Engineer fail respectively in dealing with Electrical Plant," was held at St. Bride's Institute, London, on November 28th. Mr. W. E. Highfield, president of the N.A.S.E., occupied the chair; Capt. A. E. Penn (Association of Engineers-in-Charge) dealt with the problem from the point of view of the resident engineer; and Mr. T. H. Windibank (N.A.S.E.) put the case on behalf of the electrical contractor.

Captain Penn dwelt at some length on the necessity for an electrical contractor, when dealing with installations of electrical plant, to seek out the resident engineer and work with him. He pointed to the difficulty in which the resident engineer was often placed as the result of the contractor receiving instructions from a secretary, or someone who knew little about the work. The resident engineer should be the man to inform the contractor as to what work was required to be done, and should draw up a proper specification embodying all the essential details. Taking it for granted that that specification had been drawn up, it was very necessary that the contractor should interview the resident engineer with regard to the carrying out of the work. If such a course were not adopted by the contractor this was where he failed in the first instance; there was friction at some time, and the proceedings were hampered from the commencement.

This was to be deplored, as the contractor might have made known some other proposition to the management which appeared plausible to them and feasible to him, owing to his imperfect insight into the conditions prevailing. Discussing the tendency on the part of some employers to consider that the plant which a contractor had installed was so simple and fool-proof that they could dispense with a resident engineer (the contractor having promised to look in once a month to see that things were going all right), Capt. Penn said that there was generally trouble through the failure of the contractor to be conversant with the details governing the efficient working of the whole system. A contractor should be a contractor only, and not a consultant, adviser, manufacturer, supervisor, &c., to the detriment of others who had had special training in the various phases of engineering.

The contractor, having obtained a contract for the installation of plant, probably at a cut price, might not see eye to eye with the resident engineer with regard to details. The contractor was concentrating on how the money was running out, whilst the engineer was considering what trouble the contractor was leaving behind. The manufacturer often failed in neglecting to follow up the operation of his machinery, and it was seldom that the contractor was able to locate trouble effectively, even though he might have the design of a particular machine at his finger tips, but there were exceptions.

The contractor sometimes adopted a high-handed attitude towards the resident engineer. So long as the job was secured the contractor generally declined to worry about the views of the resident engineer, and too often the customer was given the impression that the resident engineer could not be expected to understand the special apparatus. On the other hand, some firms adopted the policy that their apparatus was automatic, and required no maintenance. Capt. Penn considered that both were wrong, and that the resident engineer should take over all new plant immediately it was in running condition.

The contractor also failed in his service to the customer by cutting prices to the lowest limit to secure work, whilst another point of criticism was the practice of contractors to sub-let work to local firms, with only part-time supervision by the main contractors. The resident engineer had to make up for want of supervision, and might have difficulty in persuading the sub-contractors to see his point of view.

Mr. T. H. Windibank, speaking for the contractor, said that he had to deal with widely divergent types of resident engineers. He divided them into three classes, namely: (1) the resident engineer who was always under the direction of a consulting engineer; (2) the resident engineer who had the control of the technical side, and who was responsible to his firm in both advisory and executive capacities; and (3) one who had to accept dictation from a non-technical source. With regard to the second and third types, there was frequently to be encountered a sad lack of vision, generally evidenced by a tendency to under-estimate the future demand, and a desire to perpetuate an old fetish by introducing second-hand plant. He mentioned cases where improvements had been recommended by contractors, but had not been carried out, with the result that the resident engineers concerned had failed to get the greatest efficiency. During the progress of installation the resident engineer should always be at hand; it was to his advantage, as well as that of the contractor.

As to driving a plant, Mr. Windibank advocated that every machine in a works should be catalogued by the resident engineer with the power required. Makers' data, which was generally under-estimated, was often accepted without question. The maintenance of plant when handed over provided the resident engineer with the opportunity to make or mar the contractors' reputation. Insufficient care was given to the log book; in fact, more often than not it did not exist. Too much reliance was placed on insurance companies' reports, which were frequently belated, and varied in value in true ratio to the competency of the inspector. Standardisation had many advantages, but required handling temperately, otherwise it was liable to impede progress. The faults alleged against resident engineers, said Mr. Windibank, could be ascribed generally to incompetency, dogmatism, or limitations. With incompetents the only course was education. The dogmatic resident engineer was generally a competent man, but many years in a rut had made him distrustful of modern developments and a source of anxiety and trouble to manufacturers and contractors. The remedy in this case lay in the open discussion of daily troubles and innovations, facilities for which were offered by the Association of Engineers-in-Charge. The third cause, that of limited authority, was the outcome of unsatisfactory economic relations between engineer and employer, and emphasised the demand for recognition of engineers-in-charge as a class.

A long discussion followed, in the course of which many experiences were related, by electrical contractors and engineers-in-charge, of incompetency or efficiency on the part of both.

Co-operation was the keynote of the whole discussion. It was pointed out that the resident engineer generally was of a conservative turn of mind, because he was concerned with the constant running of the plant when installed, whereas the contractor was more liable to try to push new things forward.

Mr. C. A. Pickle said that at the present time the lowest tender was likely to be successful, and contractors were liable to cut prices too much; the engineer knew what the work could be done for, and he had difficulty in seeing that the contractor did the job properly.

Mr. J. Carter referred to a case in which he was instructed to give special supervision to a man (who was not an electrical contractor) who had cut his price, because it was realised that he could not possibly do the work for the price at which he had contracted to do it, and it was "skimped. The result was that Mr. Carter would not pass his work. It was condemned by the board, and the man was stopped. He (Mr. Carter) fancied, however, that the same sort of thing could be found with electrical contractors sometimes.

Many speakers complained that when an engineer drew up a specification, and tenders were received, acceptance often rested with a non-technical board, who went for the lowest price without further consideration. It was pointed out that there were legal difficulties in connection with drawing up specifications.

The Chairman said that in the case of large new works it was almost impossible to draw up a specification to cover every legal point

Mr. H. D. Wilkinson, dealing with non-technical boards, said it was wrong to ask an engineer to draw up specifications and then select tenders without asking for his advice.

A difficulty mentioned by Mr. Carter was that supervising electricians lacked mechanical knowledge, and that was where the resident engineer should be consulted.

Mr. F. T. Alldread, following this up, agreed, that although the resident engineer was often a good man mechanically, he was not an expert in other branches. Such troubles would be got over if the firm would call in an expert who, after consulting the resident engineer, would draw up a specification.

Mr. A. J. Stiling said that contractors would always keep to specifications, except where unforeseen difficulties arose and changes were mutually agreed upon. The contractor could not always be blamed for acting as a consultant if he did not know of the existence of the resident engineer. The necessity for the resident engineer to witness tests of machinery to be installed was also emphasised. Thus he would get to know the contractor, and would have an opportunity of seeing new work on the test bench at the same time.

Mr. Windibank, replying, agreed that electricians were weak on mechanics, but pointed out that one of the strong points in connection with the N.A.S.E. programme was education; also joint meetings with the Association of Engineers-in-Charge were very instructive, and he looked forward to many more in the future. It was the curse of the electrical industry that there was a crowd of men who called themselves "engineers" taking jobs at any price, and comfortably going bankrupt before they were finished. Referring to the slow progress of the electrical industry in this country during the last thirty years, as compared with other

countries, he said that the industry had had to fight British conservatism.

Capt. Penn, in the course of a short reply, said, with regard to specifications, that if engineers could not put on paper what they wanted definitely they should not interfere, but should call in a consultant.

RADIO-TELEPHONY.

In connection with the Engineering Exhibition that was held at Cardiff recently under the auspices of the South Wales Institute of Engineers, a conference was held at the same time at which several papers were read and discussed. Mr. David E. Roberts, president of the South Wales Institute of Engineers, occupied the chair.

Mr. E. Ogden, assistant Post Office engineer, Cardiff, read a paper on "Wireless Telephony." which was keenly followed by those in attendance.

The author explained what radio telegraphy was and how the transmitting and receiving apparatus functioned by means of a number of analogies, dealing with the subject from a more or less elementary point of view, after which, with the aid of apparatus that had been lent for the purpose, a demonstration of the reception of Morse signals and telephony was given by Mr. Abel Sanderson.

Capt. C. Crompton, superintending engineer, G.P.O., Cardiff, in opening the discussion, pointed out that the introduction of broadcasting had rendered it necessary to prescribe, to a certain extent, the wave length band in which amateurs might operate. The absence of this regulation in America had produced great confusion and it should be a matter of faith and honour in this country to see that the control regulations were strictly adhered to. The arrangements which had been made for them were very generous and if they were not properly adhered to, then further restrictions would be imposed and the great freedom which amateurs enjoyed to-day in their experimental work would be further cut down. They were placed virtually on their trial, and he would emphasise the fact that the authorities had means of tracking down offenders, no matter in what out of the way place they might be operating. The day would come when the evil doer would be tracked down and stopped altogether. Those who broke the regulations were not only doing a disservice to their brother amateurs, but also to our commercial service.

Mr. Widdowson said it seemed to him that if amateurs were going to do any good at all it meant spending a great amount of money.

Mr. George Franse and Mr. J. H. P. Berthor also took part in the discussion, after which Mr. Ogden, referring to the question of interference, explained that the ordinary amateur was not allowed a transmitting licence. There had been a few issued, but he did not think there would be many more, unless the amateur showed conclusively that he knew what he was talking about and that he was sufficiently conversant with the theory of the subject not to interfere with other stations. An amateur could receive on any wave length, but if he did not do so with discretion he would interfere with other amateurs and also with the commercial service. One valve and a crystal were sufficient if they did not want to go to much expense, though they could get far better results by using two valves and a crystal. There were a number of good books on the subject, but for general all-round knowledge the Admiralty book was extremely useful. Those thinking of building a set, he would advise to be careful of the new broadcasting licence which now bore the stamp of the British Broadcasting Co. By taking out that licence they undertook to use that apparatus only, they would not be able to go to an ordinary dealer and buy anything.

TINPLATE MACHINERY.

Visitors from West Wales were much in evidence at the Engineering Exhibition, Cardiff, on November 22nd, a large number having journeyed to the city to listen to an address on the above-named subject at the South Wales Institute of Engineers. So keen was the interest taken in the lecture that the discussion was adjourned and resumed at a special meeting at Swansea on December 4th, when the Melingriffith tinplate works were visited.

Mr. H. Spence Thomas, in the course of his address, which was illustrated with a kinematograph film, remarked, *inter alia*, that regarding the motive power, he had an open mind on the relative merits of steam and electricity. Some firms had given him figures with regard to coal consumption and, in comparing steam and electricity, they might be horrified at the high consumption of energy for driving mills by electricity, but it was only fair to say that if one used electricity it eliminated capital cost in the shape of boilers, steam pipes &c., and the cost of firing and removal of ashes, both very difficult and trying problems. One had to make due allowance for those things, but as far as he could see the cost of running the plant electrically was roughly about double that of the coal consumption alone. Whether the cost of labour and inconveniences of making steam, depreciation of boilers, superheaters, economisers, the upkeep of plant, and so on, were equivalent to about double the cost of the fuel itself was a matter for every one to work out for himself. That was the main point, in his view, as regarded a comparison between electricity and coal consumption. As to the cost of electrical plant, one would be told by the people who sold generators that they could "make the juice" for an extraordinarily low figure. If one took a supply of electricity from a power company or corporation, one would have to pay about 1d. per kWh on a tinplate works load. If one could make one's own electricity for ½d. per kWh, with coal at to-day's prices, one would halve the cost, of course. The point was, which was the correct figure per kWh, and how one paid for the energy. The great advantage of the electrical drive was that one could tell with certainty whether the mills were level or out of line, and whether anything was the matter; while with a steam drive it was difficult to tell which particular mill was wrong.

During the discussion users of the electrical drive in South Wales tinworks said that it more than held its own with the steam drive, but it was complained that the maximum demand charges were excessive. It would pay tinworks to provide their own power rather than pay these charges, said one speaker.

Mr. J. C. Howell (Llanelly) explained that his experience showed that there was very little difference in the motive power being either electricity or steam.

THE FARADAY SOCIETY.

Acidity of Natural Waters and their Action on Metals.

A paper recently read by Dr. W. R. C. Atkins before the Faraday Society, although describing work which, in its origin, is far removed from engineering practice, contained several considerations that will be of interest as bearing on corrosion and on the etching of metals as practised by metallographers in studying their structure. Modern physical chemists measure acidity in terms of the concentration of hydrogen ions (the symbol *p*H, commonly adopted, stands for the reciprocal of the logarithm of the hydrogen ion concentration). Dr Atkins's paper is a record of numerous measurements of *p*H made with various natural waters, such as rain, river and sea water, under various conditions and after various treatments, and some of the results will be of inteerst to boiler engineers. It transpires that the practice obtaining with some engineers who use very soft water of adding a small quantity of sea water to their boilers at intervals, bringing *p*H up to 11 or more, has the effect of increasing alkalinity, and so rendering the iron relatively immune from rust. This immunity is found to be due to the fact that the *p*H value is too high for any appreciable quantity of ferrous hydroxide to exist in solution, while the amount of carbon dioxide in solution as acid is also vanishingly small. In ordinary iron, however, the oxidation of the traces of compounds of sulphur present may result in the production of sufficient acid to increase corrosion. The reason why copper is not attacked by atmospheric carbonic acid is that its hydroxides are not appreciably soluble at the hydrogen ion concentrations normally found in natural waters.

It is concluded that in general a metal is not appreciably dissolved by an acid unless the concentration of hydrogen ions suffices to dissolve its hydroxide. No matter how great the acidity as determined by titration may be, no action takes place unless a suitable *p*H value is reached. For action of a selective character, therefore, it is theoretically possible to have such a *p*H value as will result in the attack of one metal by the acid, whilst the other is left intact; but again the action would be very brief when using a strong acid or a strong base.

Since the effect of dilution is much less in the case of the weak acids and bases their action remains more uniform at low concentrations than is the case with strong acids and bases. Their value as etching reagents seems to be connected with this property. It is suggested that even the action of polishing powders may not be purely mechanical.

Ionisation within the Molecule.

At the same meeting Prof. T. M. Lowry, in a very suggestive paper, drew attention to the fact that the electronic formulæ now used by chemists, based on the theory of octets (the

so-called Lewis-Langmuir atom) has made it necessary to postulate a condition of intra-molecular ionisation in a large number of compounds where the charges on the nuclei are not balanced by the enveloping electrons. The present paper deals particularly with inorganic compounds, and Dr. Lowry's suggestion explains very aptly the relative stability of the oxy-acids, such as the chloro-, sulphur-, and the phosphor-acids. The conception also leads to a novel explanation of the acidifying properties of oxygen.

STREET LIGHTING.

RECENT DEVELOPMENTS AND MODERN REQUIREMENTS.

A DISCUSSION on the above subject took place at a meeting of the Illuminating Engineering Society on December 12th, the chair being taken by Mr. A. P. Trotter.

MR. HAYDN T. HARRISON read an introductory paper referring to the great importance of good public lighting in promoting order and safety in the streets. The burden of rates was mentioned as one reason why progress was delayed. But improved street-lighting did not always mean increased expenditure. The development of fast motor traffic had revolutionised street-lighting requirements. If vehicles and pedestrians were made visible to drivers by effective public lighting, over-powerful headlights would become less needed. Mr. Harrison declared his adherence to the method of classification based on measurements of minimum horizontal illumination. He pointed out that the classification of streets on this basis by the Joint Committee in this country and by the Street Lighting Committee of the N.E.L.A. in the United States were in close accord. It was therefore surprising to find that in America it had been decided to specify the type of lamp rather than the result in the form of illumination it was desired to obtain.

The speaker also pointed out the fundamental importance of methods of spacing street-lighting units. As the distance apart of posts was usually many times their height, the illumination midway between the lamps was necessarily low. Hence the need for using very powerful lamps and accentuating the candle power at angles slightly below the horizontal. Recent developments were illustrated by reference to two recently-introduced devices, the "Holophane" prismatic street lantern and Mr. Harrison's "longitudinal" system of lighting.

The paper was followed by a contribution by MR. L. GASTER on "Street Lighting and Safety." A number of slides were shown illustrating the methods of screening adopted during the war, and the consequent "patchy" illumination under the lamps. Statistics had been obtained showing a marked increase in street accidents during the period 1913-1916, and it was evident that the diminished public lighting was one contributory cause. Statistics on accidents in seven American cities, with a combined population of over seven millions, had confirmed this conclusion. It was estimated that 17.6 per cent. of accidents occurring at night were due to inadequate lighting. The present time, when many firms were in need of work, and widespread unemployment was giving rise to much concern, appeared opportune for putting in hand street-lighting improvements, which would in any case become necessary later on. In conclusion, Mr. Gaster summarised the chief requirements of street lighting from the safety standpoint, dwelling on the desirability of avoiding glare and excessive contrasts and aiming at uniformity of effect. Well-diffused private lighting should also be encouraged, as this was a valuable supplement to public lighting. The lighting of roads—particularly main thoroughfares and important arteries of traffic—was not a parochial but a national matter. It appeared that the time had come when public lighting, like the upkeep of road surfaces, should be supervised by an appropriate central authority and conducted on a uniform plan.

The discussion was opened by DR. CLAYTON SHARP, who has been intimately associated with street lighting improvements in the United States. Dr. Sharp referred to the ornamental lanterns made up of diffusing glass, which had become usual in America. The provision of a certain horizontal illumination was one important factor, but not the only one. A specification describing completely the nature of the lighting fittings to be adopted was necessary. Special appliances had been devised for testing the candle-power of the lamp *in situ*, and it must be recognised that accurate measurement of illuminations of the order of 1/100 foot-candles was extremely difficult. A feature had been the setting aside of a complete length of road where experiments with various systems of lighting could be tried out. The tests were not confined to measurements of candle-power and illumination, but were also directed to ascertaining freedom from glare. Experiments had also been made to ascertain how well the illumination would reveal obstacles on the road.

MR. FRANK BAILEY considered that measurements of illumination were of fundamental importance as a test of street-lighting conditions. Authorities were apt to complain of the cost of street-lighting, but did they sufficiently realise its benefits? There were many narrow streets in the city where traffic was crowded, and where extensions and widening of the road would cost enormous sums. In such cases a needed improvement could be made by introducing better lighting which would facilitate more rapid movements of traffic.

CAPT. W. J. LIBERTY (City of London), MR. S. B. LANGLANDS (Glasgow), and MR. R. DAVISON (Newcastle-on-Tyne) referred to street-lighting developments in their respective districts, and MR. J. G. CLARK mentioned "visibility" as the determining factor in street-lighting. He was not satisfied that perfectly uniform illumination was desirable in this respect.

MR. H. L. THOMSON (Chairman of the Lighting Committee of the City of Westminster) expressed his belief that candle-power was the best basis on which to frame lighting contracts. It was not desirable that *all* light should be concentrated on the roadway. The illumination of the façades of important public buildings was a useful feature, and in this field the co-operation of the architect would be welcome.

MR. HAYDN T. HARRISON briefly replied to the discussion, and the Chairman announced that the next meeting would be held on January 16th, when there would be a discussion on "The Need for Suitable Training in Illuminating Engineering."

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.

33,361. "Cathode ray oscillographs." F. R. F. Ramsay. December 6th.
33,402. "Tramway rails." T. Brooks. December 7th.
33,417. "Aerial and antenna systems for wireless telegraphy, &c." H. Morris-Airey and C. Seymour. December 7th.
33,421. "Transmission of audible code signals for fire alarms." C. Smith and G. J. Sutton. December 7th.
33,425. "Electron discharge devices." Western Electric Co., Ltd. December 7th. (United States, July 29th.)
33,430. "Receiving apparatus for wireless signalling." H. P. P. Rees. December 7th.
33,440. "Method of treating electro-conductive and moisture-bearing materials." E. M. Crowther, W. B. Haines, and Sir E. J. Russell. December 7th.
33,453. "Signalling apparatus for railways, &c." Westinghouse Brake and Saxby Signal Co., Ltd. December 7th.
33,466. "Automatic calling selectors for telephone installations." L. d'Haenens. December 7th. (Belgium, December 9th, 1921.)
33,468. "Method of operating electric tools." Central Electric Tool Co. December 7th. (United States, January 4th.)
33,470. "Receiving tuners for wireless apparatus." R. Rutherford. December 7th.
33,476. "Apparatus for automatic adjustment of electrical potential of grids, &c., of thermionic valves." W. J. Rickets. December 7th.
33,477. "Electrical ignition, &c., systems." L. Renault. December 7th. (France, September 22nd.)
33,493. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. December 7th.
33,507. "Electric transmission." A. M. Taylor. December 8th.
33,521. "Magnetos." R. C. J. Boaler. December 8th.
33,526. "Shackle and pin for colliery trams, &c." R. S. Butler. December 8th.
33,534. "Electric switches." F. H. M. Swinburne. December 8th.
33,555. "Means for flattening current waves of pulsating direct current." C. A. H. Haighton. December 8th. (Holland, December 10th, 1921.)
33,566. "Electrical device for dimming lights and warming carburettor on motor-cars, &c." J. L. Strang. December 8th.
33,569. "Two- or three-electrode condenser." A. H. Norman, J. F. R. Shand, and R. F. Shand. December 8th.
33,578. "Telephone attachments." A. N. Pass. December 8th.
33,583. "Gear for agitating and circulating liquid in dye vats, &c." English Electric Co., Ltd. December 8th.
33,587. "Manufacture of fused quartz by electric furnace." Soc. Anon. Quartz et Silice. December 8th. (France, December 16th, 1921.)
33,588. "Manufacture of fused quartz by electric furnace." Soc. Anon. Quartz et Silice. December 8th. (France, December 16th, 1921.)
33,602. "Locking means for securing electric lamps in sockets." H. G. Farr. December 8th.
33,603. "Magnets." W. B. Sayers. December 8th.
33,604. "Electric transformers." M.L. Magneto Syndicate, Ltd., and G. K. Morris. December 8th.
33,609. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). December 8th.
33,610. "Speed indicators." British Thomson-Houston Co., Ltd., and A. P. Young. December 8th
33,614. "Primary cells." A. C. Goolden, D. J. Macnaughton, and H. Moore. December 8th.
33,615. "Multiple-way selector switch." F. H. Madsen. December 8th.
33,616. "Clamping device for electric switchboards." F. H. Madsen. December 8th.
33,621. "Means for starting arc in arc lamps." C. B. Mitcalfe-Dale and A. J. Packham. December 8th.
33,650. "Electric lamp globes." J. J. E. Sloan. December 9th.
33,655. "Telephonic transmission of images, &c." J. Dimsdale and J. Kean. December 9th.
33,664. "Electric arc projectors." H. S. Webster. December 9th.
33,684. "Variable electric condensers." L. N. Hall. December 9th.
33,691. "Grid leaks and like electric resistances." A. E. Chapman. December 9th.
33,694. "Electric devices for controlling flow of liquids." A. G. Jackson. December 9th.
33,696. "Sealing and protecting ends of electric conductors." A. E. Frankling and W. J. Spencer. December 9th.
33,700. "Dynamo electrical machines." British Thomson-Houston Co., Ltd., and A. P. Young. December 9th.
33,702. "Magneto-electric generators." G. E. Balrsto. December 9th.
33,713. "Electric switches." J. A Crabtree. December 11th.
33,720. "Electric lock." J. W. Hanson and J. G. Haywood. December 11th.
33,721. "Electric couplings." W. A. Eastway. December 11th.
33,735. "Electric oven." F. Hoppe. December 11th.
33,747. "Galvanic batteries or cells." W. H. Edridge. December 11th.
33,754. "Means for transmitting and receiving wireless messages." F. W. V. Fitzgerald. December 11th.
33,775. "Receiving apparatus for wireless signalling." H. P. P. Rees. December 11th.
33,784. "Speed-controlling devices for trains." E. Rodolausse. December 11th.

33,804. "Electrical means for starting up internal-combustion engines." E. T. Fisk. December 11th.
33,806. "Locking apparatus for incandescent electric lamp sockets." G. Brambilla. December 11th.
33,818. "Trolley poles, &c." P. Robbins. December 11th.
33,826. "Automatic apparatus for shutting off controls of electric current, water flow, &c." G. C. Clark. December 12th.
33,839. "Electric torches." Efandem Co., Ltd., and G. Green. December 12th.
33,844. "Distributors, commutators, &c." J. S. Foley. December 12th.
33,886. "High-frequency electric installations." G. A. Beauvais. December 12th. (France, December 12th, 1921.)
33,889. "Illuminated advertising devices." E. D. Mallinson and G. Spencer, Moulton & Co., Ltd. December 12th.
33,902. "Starting and priming devices of internal-combustion engines." F. E. Morriss. December 12th.
33,905. "Electrical indicating instruments." Evershed & Vignoles, Ltd., and J. C. Needham. December 12th.
33,910. "Automatic control of dynamo-electric machines." British Thomson-Houston Co., Ltd., and C. J. Sargeant. December 12th.
33,926. "Reception of wireless signals." A. L. A. Petty. December 12th.
33,927. "Electro-magnetic indicating device." F. W. Leake and Tyer and Co., Ltd. December 12th.
33,929. "Electric driving gearing on motor vehicles, &c." C. J. Gordon. December 12th.
33,931. "Tramway, &c., signalling systems." P. H. Waller. December 12th.
33,937. "Galvanic batteries." Oldham & Son, Ltd., and W. D. Wilde. December 12th.
33,938. "Spark plugs." A. E. White (Brewster Goldsmith Corporation). December 12th.
33,939. "Spark plugs." A. E. White (Brewster Goldsmith Corporation). December 12th.
33,940. "Spark plugs." A. E. White (Brewster Goldsmith Corporation). December 12th.
33,941. "Electric filter circuits." A. G. Lee. December 12th.
33,949. "Rectifying devices." A. R. Angus. December 12th.
33,969. "Apparatus for utilising energy of flowing water for production of electricity, &c." F. Horridge. December 13th.
33,978. "Combined electrical fitting and attachment therefor." J. N. Robson. December 13th.
34,012. "Supporting means for electric, &c., lamps." A. Lewis. December 13th.
34,015. "Intervalve coupling transformers and inductances." E. Redpath. December 13th.
34,019. "Tram rails, &c." E. T. Wood and W. B. Wright. December 13th.
34,020. "Ignition systems for internal-combustion engines." H. E. Fellows. December 13th.
34,032. "Rotors for dynamo-electric machinery." K. Baumann, T. H. Charlton, G. A. Juhlin, J. A. Kuyser, and Metropolitan-Vickers Electrical Co., Ltd. December 13th.
34,045. "Electric heating devices." C. G. Nobbs and W. W. Nobbs. December 13th.
34,046. "Remote control of electrically-actuated apparatus." L. H. Peter, B. H. Peter, and Westinghouse Brake and Saxby Signal Co., Ltd. December 13th.
34,049. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. December 13th.
34,053. "Dynamos, electric motors, &c." J. R. Pullon and G. H. Tatham. December 13th.
34,072. "Lead-covered cables for electric transmission." A. M. Taylor. December 14th.
34,074. "Automatic telephone systems." J. Berry, and Siemens Bros. and Co., Ltd. December 14th.
34,089. "Thermionic valves." C. V. Morris. December 14th.
34,094. "Electric generators or dynamos for motor-vehicle lighting." F. Dunn. December 14th.
34,097. "Magnetic measuring and controlling apparatus." C. L. Sumpter. December 14th.
34,098. "Switch mechanism for electric lighting installations." C. Sugden. December 14th.
34,125. "Electric condensers." A. Onwood. December 14th.
34,133. "Connections for wireless receiving apparatus." C. F. Elwell, Ltd., and B. E. G. Mittell. December 14th.
34,141. "Electric motor-control systems." Metropolitan-Vickers Electrical Co., Ltd. December 14th. (United States, December 17th, 1921.)
34,158. "Asynchronous induction machines." T. Torda. December 14th. (Hungary, May 10th.)
34,162. "Coil ignition and electric lighting unit for motor vehicles." D. A. V. Rist. December 14th.
34,173. "Variable-speed driving mechanism." British Thomson-Houston Co., Ltd. December 14th.
34,174. "Protective devices for dynamo-electric machines." British Thomson-Houston Co., Ltd., H. C. Hastings, and C. J. Sarjeant. December 14th.
34,175. "Sound-emitting apparatus." British Thomson-Houston Co., Ltd., J. H. Butcher, and A. P. Young. December 14th.
34,176. "Amplifiers." British Thomson-Houston Co., Ltd. December 14th. (United States, December 14th, 1921.)
34,181. "Method of transmitting pictures to a distance." Picturadio Corporation. December 14th. (United States, June 13th.)
34,182. "Electro-magnetic sound receiving and producing devices." C. W. Clarabut. December 14th.
34,183. "Electro-magnetic sound receiving and producing devices." C. W. Clarabut. December 14th.
34,186. "Registering telephonic conversations." S. Brociner and E. Freund. December 14th. (Austria, December 15th, 1921.)
34,192. "Variable condenser." S. H. Green. December 15th.
34,200 "Electric apparatus for production of peroxides of nitrogen." F. Stacey. December 15th.
34,214. "Means for controlling head-lights." B. L. Roberts. December 15th.
34,215. "Magnetic hand hammer." H. J. Dale. December 15th.
34,219. "Arrangement for locking electric light bulbs, &c." S. J. Edbrooke. December 15th.
34,220. "Burglar, &c., alarm." C. Couch. December 15th.
34,233. "Combined filament rheostat and crystal detector." F. H. Blaxley and E. E. Peace. December 15th.
34,234. "Terminals, &c., for high-voltage electrical apparatus." F. Coates and A. Reyrolle & Co., Ltd. December 15th.
34,238. "Burglar alarm." W. H. Llewellyn. December 15th.
34,245. "Electrical heating apparatus." J. R. Quain. December 15th.
34,247. "Gas or electric cooking apparatus and grill." W. E. Cocks. December 15th.
34,248. "Asynchronous induction machines." T. Torda. December 15th. (Hungary, September 20th.)
34,258. "Thermal switch adaptor or coupling units for electric incandescent lamps." E. H. Brinsden and H. M. Edwards. December 15th.
34,259. "Thermal switch adaptor or coupling units for electric incandescent lamps." E. H. Brinsden and H. M. Edwards. December 15th.
34,266. "Electric switches." Rolls-Royce, Ltd., and F. H. Royce. December 15th.
34,269. "Drive for dynamos on motor-cycles, &c." S. G. Muir and E. G. Pyne. December 15th.
34,275. "Asynchronous induction machines." T. Torda. December 15th. (Hungary, June 3rd.)
34,276. "Thermally-actuated electric switches." C. French and E. French. December 15th.
34,279. "Tuning coils for wireless telegraphy." E. J. Clarke. December 15th.
34,296. "Polyphase asynchronous motors." F. Ernstein. December 15th.
34,298. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and H. C. Hastings. December 15th.
34,299. "Head attachment gear for telephone receivers, &c." British Thomson-Houston Co., Ltd., J. H. Butcher, and A. P. Young. December 15th.
34,307. "Encasing or lagging pipes, electric cables, &c." F. J. Commin. December 15th.
34,313. "Electric terminal connector." J. Gell. December 15th.
34,316. "Asynchronous induction machines." T. Torda. December 15th. (Hungary, October 21st.)
34,362. "Thermionic discharge devices." Radio Communication Co., Ltd., and E. H. Robinson. December 16th.
34,363. "Use of fluid conductors in high-frequency signalling systems, &c." Radio Communication Co., Ltd., and E. H. Robinson. December 16th.
34,374. "Devices for charging accumulator cells." A. R. Angus. December 16th.
34,379. "Electric drive for gramophones." V. E. Antrique. December 16th.
34,385. "Induction coils, variometers, &c" H. C. Barker. December 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

26,950. "Telegraph keyboard perforators." A. C. Booth and A. S. Willmot. June 1st, 1921. (189,474.)

1921.

17,937. "Electro-magnetic clutches." P. R. Jackson (Sperry Gyroscope Co.). July 1st, 1921. (189,483.)
19,937. "Electric hand drills." I. Sweetland. July 25th, 1921. (189,484.)
20,763. "Electric heaters." A. Selvatico. August 4th, 1921. (189,497.)
22,317. "Commutators or rotary ignition current distributors for internal-combustion engines." J. Judge. August 23rd, 1921. (189,500.)
22,657. "Magneto-electric generators." W. P. Thompson (Splitdorf Electrical Co.). August 26th, 1921. (189,509.)
22,861. "Direction-finding apparatus for use in wireless telegraphy." L. G. Preston, Dr. B. Hodgson, C. E. Horton, and G. W. Harris. August 29th, 1921. (189,516.)
23,168. "Method of mending electric resistance elements." N. Carrico and F. C. Hughes. September 11th, 1920. (169,157.)
23,229. "Electric couplings." W. Thompson. September 1st, 1921. (189,541).
23,437. "High-frequency telegraphy and telephony." Ges. für Drahtlose Telegraphie and Dr. H. Gewecke. September 29th, 1920. (169,691.)
23,938. "Electric switches, particularly for use with electrically-heated irons." C. W. Denny. September 8th, 1921. (Cognate applications 26,125/21 and 6,202/22.) (189,573.)
23,974. "Acoustical apparatus for telephonic communication." Signal Ges. September 27th, 1920. (169,438.)
23,990. "Testing devices for electric ignition systems." J. H. Runbaken and W. Torrance. September 8th, 1921. (189,574.)
24,443. "Portable electrically-driven combination tools." F. Pooley, F. C. Austin, and W. L. Wreford. September 14th, 1921. (189,576.)
24,563 "Method of protecting polyphase supply circuits on the occurrence of an earth connection." Akt. Ges. Brown, Boveri et Cie. September 16th, 1920. (169,175.)
25,597. "Electric terminals." Efandem Co., Ltd., and J. Eaton. September 16th, 1921. (189,577.)
24,642. "Electro-mechanical motion-transmitting devices for automobiles or the like." T. A. T. Rydberg. July 26th, 1921. (183,789.)
25,719. "Galvanic batteries." G. Oldham and J. Oldham. September 29th, 1921. (Cognate application 17,734/22.) (189,589.)
25,798. "Operating mechanism for electric switches." W. A. Coates and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1921. (189,591.)
26,302. "Electrical control systems, particularly adapted for lifts, haulage gear, and the like." Electric Control, Ltd., and O. Ellefsen. October 5th, 1921. (189,594.)
27,367. "Supports or holders for electric conductors." A. Wiseman and J. W. Harris. October 15th, 1921. (189,604.)
27,741. "Railway rail chairs for holding bull-head conductor rails upright without keys or other fastenings." R. S. Proud. October 19th, 1921. (189,616.)
27,934. "Overload trip retarding or delaying device for electric circuit breakers or automatic switches." Electric Construction Co., Ltd., and F. W. Close. October 21st, 1921. (189,617.)
30,183. "Clamping arrangement for sheet metal stator teeth of electrical machines." Maschinenfabrik Oerlikon. November 17th, 1920. (171,688.)
31,147. "Terminal ends for electric wires and cables." L. F. Summers. November 22nd, 1921. (189,641.)
32,160. "Wireless telegraph receivers." L. B. Turner. December 1st, 1921. (189,645.)
32,876. "Electric starting motor for internal-combustion engines." C. A. M. Buckley. December 7th, 1921. (189,652.)
33,128. "Ignition devices for use in explosion motors." F. L. Eldridge. December 9th, 1921. (Cognate applications 9,321/22 and 21,403/22.) (189,656.)
33,701. "Safety vents for electric motor cases, switch boxes, junction boxes, and the like." Electric Construction Co., Ltd., and F. W. Close. December 15th, 1921. (189,664.)

1922.

482. "Trolley wheels for electric current collectors." G. H. Boot. January 6th, 1922. (189,678.)
1,651. "Electric fuses, cut-outs, or the like." Siemens Bros. & Co., Ltd., and H. G. Wood. January 19th, 1922. (189,684.)
2,277. "Automatic electric fuse switches." Bayerische Elektrizitäts-Industrie Rott & Co. January 25th, 1921. (174,617.)
3,645. "Wireless telegraph receivers." L. B. Turner. February 8th, 1922. (189,693.)
5,509. "Electric soldering irons." J. F. Coeuille. June 15th, 1921. (181,680.)
5,749. "Electrically-heated laundry irons." H. Booth. February 27th, 1922. (189,704.)
11,401. "Telephone cables." Johnson & Phillips, Ltd., and G. C. Pearson. April 22nd, 1922. (189,716.)
13,442. "Electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). May 12th, 1922. (189,720.)
14,648. "Electric torches." M. Goodfellow and Ever Ready Co. (Great Britain), Ltd. May 24th, 1922. (189,724.)
22,500. "Electrically-controlled valve gears for reciprocating steam engines." O. Simmen. August 24th, 1921. (185,111.)
31,360. "Electric signalling over cables." B. Davies and Eastern Telegraph Co., Ltd. June 23rd, 1921. (Divided application on 17,334/21.) (189,733.)